



2015 MARINE CORPS

SECURITY ENVIRONMENT FORECAST

FUTURES 2030-2045



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About Futures Directorate

The Futures Directorate was established in July 2013 to promote greater unity of effort among the organizations responsible for capabilities development within Combat Development and Integration (CD&I). Futures Directorate (FD) is composed of a headquarters and three subordinate organizations: the Futures Assessment Division (FAD), Emergent Force Development (EFD) Division, and the Marine Corps Warfighting Laboratory (MCWL). The Director, Futures Directorate also serves as the Commanding General of MCWL, the Vice Chief of Naval Research, and the Marine Corps Executive Agent for Science and Technology.

Futures Directorate's mission is twofold. First, it involves identifying and assessing plausible future security environments. It also includes developing and exploring warfighting concepts and concepts of operation. The purpose is to identify potential future capability gaps and opportunities in order to inform future force development.

Within Futures Directorate, FAD assesses plausible future security environments and generates ideas that inform the development and implementation of concepts, capabilities, and requirements. FAD also provides recommendations for service consideration in order to guard against strategic surprise, shape the future force, stimulate thought and debate, and inform the Marine Corps' senior leadership.

This is FD's inaugural Marine Corps Security Environment Forecast. Interested readers should direct questions and comments, as well as any requests for additional copies, to Mr. Jim Trahan, Deputy Director, Futures Assessment Division at james.trahan@usmc.mil or (703) 784-1317.

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Foreword

The challenges to global stability, prosperity, and peace in the 21st century are vastly more complex and uncertain than those of the last century. Globalization is contributing to increased political, military, and economic competition and increased velocity of change in a more connected, interactive, information-driven international environment. Effective planning in this situation calls for enhanced foresight and revitalized efforts to study the future. Consistent with its mandate, the Futures Directorate must anticipate the many possible characteristics of the future, describe the attributes of these possibilities, and encourage Marines at all levels to anticipate and prepare for the diverse challenges of the future security environment. Today's Marines must resist the complacency that can come with institutional inertia, and they must work to develop the capability to innovate at both individual and institutional levels. Even if we do not anticipate the future perfectly, this capability will arm us with the qualities and skills needed—flexibility, versatility, speed, and efficiency—to adapt to the challenging future we will ultimately face.



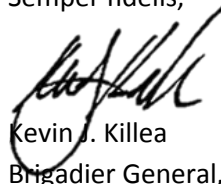
The Marine Corps is striving to adjust the force in a manner that balances efforts to eliminate the capability gaps of current operating forces, build the emergent force capabilities envisioned in the capstone concept *Expeditionary Force 21*, and reduce the institutional risk inherent in the unpredictable environments of the deeper future. At the same time, the Marine Corps must continue to succeed at the very practical tasks associated with recruiting and training Marines and fielding and sustaining equipment that meet the Nation's day-to-day demands. Getting the balance right is a daunting challenge, and it is tempting to focus solely and comfortably on the immediate future (i.e., the Program Objective Memorandum [POM] cycle), ignoring the difficult-to-discern threats and opportunities of the deep future.

Forecasting is essential to efforts to cope with and prepare for the uncertain future. The Marine Corps Security Environment Forecast (MCSEF) embodies the Marine Corps' efforts to gain a comprehensive understanding of several deep futures that are plausible during the period 2030 to 2045. Futures Directorate produces the MCSEF in coordination with the Marine Corps Intelligence Activity (MCIA) and the more certain, nearer-focused efforts of the intelligence community. The

MCSEF will inform future editions of the MCIAs *Future Operating Environment 2015-2025: Implications for Marines* and related products. The MCSEF will also contribute to future updates to *Expeditionary Force 21*. Finally, the MCSEF will inform research, development, and experimentation efforts to ensure the Marine Corps is optimizing to face today's challenges, adapting to the evolving requirements of the coming decade, and preparing to mitigate the effects of strategic surprise should the distant challenges of the deep future appear on the battlefield sooner than anticipated.

This MCSEF provides a current snapshot of Futures Directorate's continual examination of the deep future. It aims to contribute to collective efforts that ensure the Marine Corps produces the right force in the right place at the right time. The Marine Corps must evolve and shape that force now for the future while guarding against strategic surprise and the risk of preparing too narrowly for a future we *want* rather than the future that eventually emerges.

Semper fidelis,

A handwritten signature in black ink, appearing to read 'K. Killea', written over a circular stamp or seal that is partially obscured.

Kevin J. Killea
Brigadier General, U.S. Marine Corps
Director, Futures Directorate

Executive Summary

A Wave-Top View

Capitalizing on strategic foresight techniques, the MCSEF examines global patterns and trends, develops insights on the character of future conflict, and outlines variations of the future security environment. Analysis of patterns and trends in seven categories—demographics, technology, resource competition, environmental stresses, globalization, governance, and urban littorals—enables projection 15 to 30 years into the future of four plausible world futures: a baseline future, two alternative futures, and a “preferred” future.¹ Within each category, this forecast examines the current state, principal patterns and trends, and implications. It extends the principal patterns and trends within each category on their current trajectories to develop the baseline future. Next, it varies sets of selected trends to formulate two plausible alternative future worlds. Finally, to develop the preferred future, the MCSEF examines global trends in the context of current plans, policies, and programs as reflected in official publications, resulting in a description of the future for which the Marine Corps currently appears to be preparing.

Relevant Patterns and Trends: A Foundation

Examination of key patterns and trends in chapter 2 forms the foundation of the MCSEF. The forecast begins by exploring demographic trends, which tend to be reliable as they follow rather straightforward progressions. Key demographic patterns and trends relate to global population diffusion, urbanization, migration, and population aging. The world’s population is dispersing, and United Nations (UN) forecasts indicate 28 countries will contain 75 percent of the world population by 2030 compared to 21 countries in 1950 and 26 countries in 2013. Most of these people will live in large cities. Urbanization will continue to increase as people opt for the convenience, resource accessibility, and employment opportunities available in bustling, vertical conurbations. International migration is the most difficult demographic trend to forecast, since less predictable socio-economic, environmental, and political factors often drive migration patterns. Population age is an easier metric to track and project. Due to declining global fertility, the world population is

¹ A “preferred” future represents an idealized future. It normally derives from institutional culture and momentum. It may be shaped primarily by political, cultural, or programmatic factors, and it usually represents an orthodox view of the future. It typically emerges from past practices, stakeholder interests, and the competition for national, institutional, or corporate resources.

aging. The average age in 1950 was 24, in 2013 it was 29, and in 2040 it is projected to be 35. Youth bulges (when young adults make up an unusually large share of the working-age population) are critical because of their positive correlation with the risk of political violence and social unrest, and trends suggest that youth bulges will develop and dissipate, mostly in Africa, during the forecast period. The size and strength of working-age populations have significant implications for national (and military) power because this cohort encompasses those able to serve in the military, those contributing directly to the economy, and those developing and maintaining technological expertise and capabilities.

Next, the MCSEF addresses technology's current state in five broad areas: global interconnectedness, the pace and change of technology and its diffusion, technology development and government innovation funding, the pace of innovation in the private sector, and technology associated with economic growth. New technology is connecting the world in incredible and

Globalization, fueled by advances in technology, transportation, and telecommunications, will continue to connect the world in all domains.

ingenious ways. The developing world is absorbing technology (cell phones, social media, etc.) at a staggering rate. Billions of people are accessible through handheld devices, exploitable for reasons both good and evil. As technology advances and proliferates, it becomes accessible not only to nation-state governments, but also to ordinary citizens and non-state actors of every description. Suddenly individuals and organizations—both large and small—become players on a more even, fluid, connected playing field that is entered from different angles with a click of a button or a tap of a screen. The government role in research and development (R&D) funding is critical since it

typically leads in marshalling the resources needed to embark on massive, multidisciplinary innovation experiments. Because of R&D funding's link to a government's economic strength, it is likely that, as their economies grow, developing countries will experience an increase in technological innovations relative to developed countries

There are three major implications of technology trends. First, advancing technology depends on key science and technology enablers reaching critical levels of advancement, effectiveness, and/or efficiency. Second, although advanced capabilities will be available to state- and non-state actors, and in some cases to individuals, the final products will be composed of different technologies combined in a single device or a complex system. Third, countries will be challenged to find ways to capture and reap the benefits from new technologies while simultaneously dealing with potential threats these technologies pose; this reinforces the importance of continued U.S. government-funded R&D.

Despite grand technological projections, advancements in technology are unlikely to markedly diminish the competition for resources, the third trend category. Population growth, urbanization, globalization, and changing consumption patterns will affect the availability of water, food, and energy resources. Even though water is the most important resource for human survival, over 700 million people currently lack access to clean water and over 2 billion lack suitable

sanitation services. Global hunger, however, has decreased by 17 percent (according to a 2013 UN study). The UN estimates global energy demand will increase by 50 percent by the forecast period. Renewable energy will become increasingly useful for alleviating some of the pressures placed on the supply of oil and hydrocarbons. In the competition for resources, water, food, and energy shortages may contribute to an increased likelihood of instability and crises. The number of humanitarian assistance operations will likely increase as key resource shortages intensify. Contaminated water sources, in particular, will pose a risk to U.S. personnel required to operate in unstable, afflicted regions.

Fourth, stresses on the environment, largely attributable to economic development and climate change, are affecting the global outlook. Projections indicate the planet will warm throughout the 2030 to 2045 timeframe, with ocean temperatures and sea levels rising. Potential regional food shortages, desertification, and migration by distressed populations are major implications of continuous and increasing stresses on the environment. Although some nations may resist measures to reduce carbon output due to anticipated economic consequences, it appears the U.S. Department of Defense will continue to experiment with and develop an energy efficient force with a limited carbon footprint. As the earth changes, the U.S. will be forced to adapt and tailor its force to meet the demands of a stressed and ever-changing environment. For example, as the Arctic ice pack continues to melt and the Arctic Ocean becomes navigable for longer periods, northern neighbors (Russia, Canada, and Norway) will likely race to establish authority in the area. Significant stresses on the environment correlate with an increase in the frequency and intensity of extreme weather events, leading to the need for more frequent humanitarian assistance interventions. In a more connected world, regional weather, food, and health conditions will likely impact larger portions of the world's population. Globalization will multiply and strengthen the links among people, organizations, and nations.

Fifth, globalization, fueled by advances in technology, transportation, and telecommunications, will continue to connect the world in all domains. Economies, markets, societies, and cultures will continuously integrate, as people are able to reach—both virtually and literally—all corners of the world with relative ease. Globalization will also increase the complex nature of economics and governance. Changes in economic power tend to fluctuate, but there are a few consistent key trends: the narrowing gap in per capita GDP among nations, economic power shifts from the West to the East and South, a widening gap between rich and poor, and a growing middle class. These economic changes not only diffuse power, but they also empower individuals and impact governance dynamics. Globalization will enable multinational organizations to increase their influence relative to national governments. Individual expectations and empowerment will rise, and integration will transcend traditional borders. The relative advantage that developed nations have enjoyed for decades will erode as government and military power become more difficult and costly to maintain. The world will become multipolar and interdependent, forcing individuals and organizations to cope with an increasingly complex, globalized world environment. Governments that fail to effectively face and manage this new world order will risk replacement by alternate entities.

In a rapidly globalizing world, the sixth trend area, governance, poses significant challenges. In the emerging future, governments must grapple with a new world order in which power diffuses among radical movement groups, criminal organizations, empowered individuals, and peer and near-peer nation-states. Instability will likely spread rapidly as oscillations in power and public sentiment become more common and as borders become less relevant. Today's groups such as the Islamic State in Iraq and the Levant, Boko Haram, and Hezbollah are capitalizing on voids within current governance systems, and this trend will continue. As groups and individuals become more engaged and empowered, they will become increasingly able and willing to exploit gaps in governance, injecting their own alternative forms of governance. National governments, if they are unable to adapt and respond to power shifts, will find themselves overcome by non-state actors usurping national control. It will be imperative that nation-state governance become more relevant and responsive.

Finally, governments will need to address continuing human migration to littoral urban areas as a significant portion of the world's population will live within 160 kilometers of a coastline. By 2030, there will be 41 megacities, those with a population exceeding 10 million. Major implications include a greater strain on infrastructure and resources, a higher potential for unrest, and possible havens for criminal and terror organizations.

The Character of Future Conflict: A Context

Clearly, the consequences of these major global trends will affect where and how humans live, work, innovate, interact, and govern, as well as how individuals, communities, and political entities will evolve. These trends will also influence the character of future conflict. Technological advancements will empower military leaders to engage adversaries with minimal overt involvement and precisely where the engagement results in the most favorable outcome. Future battles will often be fought in population centers, driving policy makers to favor non-kinetic capabilities and alternate approaches to conflict resolution. A more connected and individually empowered citizenry will be less tolerant of destruction and casualties. Conflict will likely continue to diminish, as will combat death rates, which were 300 per 100,000 during World War II, 30 per 100,000 during the Korean War, and 1 per 100,000 so far during 21st century conflicts. While intense combat may be on the decline, there will be increased complexity between opposing wills, and because of technological advances in all domains the consequences of miscalculation by major powers hold the potential for catastrophe. Defining success and victory will become increasingly difficult.

The assessment of principal patterns and trends provides a foundation and the examination of the character of future conflict provides a context for developing several credible views of the future in 2030-2045.

An Array of Futures

Combining the aforementioned trends and the changing character of conflict, then extrapolating 15 to 30 years, yields the baseline future described in chapter 4. The baseline future is an apparently probable scenario based on current patterns and trends. It is a world driven by social unrest and marked by instability, complex conflict, food and water shortages, and severe natural disasters. If current patterns and trends continue, the world will reorient centered on massive, multifaceted urban clusters. Three-quarters of the world's population will live in cities and there will be 41 megacities worldwide by 2030, making urbanized warfare unavoidable. Conflicts in megacities, will force both antagonist and protagonist not only to master the "Three Block War," but also to think vertically and adapt to "Three Floor Wars"—aiding noncombatants on one floor or evacuating them from a rooftop, detaining adversaries on a second level, and maneuvering offensively inside the spaces of a third.

Chapter 5 sketches two alternative futures in which specific pairs of trends have veered off their anticipated courses. Water scarcity resulting in massive migration plagues the first alternative. The world is affected by the overwhelming lack of fresh water. The developed world is keenly aware of its daily water usage, while the developing world may go days without access to fresh water. A more introspective United States becomes an even greater destination for migration, forcing heightened efforts to restrict borders and strictly manage immigration and immigrant populations. China and India play increasingly larger global leadership roles and step up militarily to fill voids left by significant U.S. military drawdowns. Fresh water scarcity and overwhelming international migration, which at times overstress the coping capabilities of recognized governments, provide non-state actors with opportunities to become viable alternatives to traditional governance. The U.S. must rely more heavily on international partners as fiscal constraints and domestic issues grow more pressing.

In the second alternative future, the United States is no longer the recognized world leader. The Nation has decreased its basic research funding, which permits competitors to catch up to and perhaps surpass the U.S. The world finds that technology and knowledge developed with beneficial outcomes in mind are being "hijacked" for nefarious ends. Globalization and the democratization of technology give rise to a multipolar world in which anti-access/area denial technology is readily available. China and India have become near-peer competitors with the United States. State and non-state actors increasingly opt to invest in technology over personnel. Significant medical breakthroughs are prolonging life and enabling advances in DNA-tailored remedies and/or ailments. Technological advancement and proliferation have made biological weapons more affordable and available. Extensive, reactive, and necessary pre-deployment preventive health measures hinder the military's responsiveness. Most U.S. forces remain in CONUS to cut defense costs. Although urban

Global proliferation of technology-enabled precision systems will also provide the means for more selective application of military power, yet in the hands of both state and non-state actors it carries the potential for wide scale disruption and destruction.

growth continues, a desire to leave the cities grows rapidly as bioengineered viruses threaten overpopulated centers. In the final analysis, the United States is unable to maintain technological or military dominance as the drastic decline in U.S. basic and applied research, global democratization of technology, and rapid spread of ruin-causing knowledge force the Nation to focus primarily on internal affairs.

Lastly, the preferred world in chapter 6 is driven by politics, consensus, and in some cases personal influence. The preferred future is possible, but it may be unlikely since it does not incorporate independent patterns-and-trends analysis. The United States remains a global political, economic, social, and cultural leader and works with international organizations and allies to achieve a rules-based international order. However, the U.S. is no longer the sole superpower as China and India are capable of challenging U.S. leadership and actions. Latin America and Africa increase their economic power, forcing international organizations to become more inclusive. Turkey is a regional political leader, while other nations in Africa and the Middle East remain fragile and unstable. Nuclear proliferation throughout the Middle East remains a major concern, since nations are able to purchase advanced weapons and equipment from China, Russia, and North Korea. Russia has created a sphere of influence and control in the Arctic. Dominance in technology and cyberspace become critical as adversaries seek to exploit gaps in the electromagnetic spectrum. The United States maintains marginal superiority in technology but China, Russia, India, and Germany are close behind with innovative counter-technologies. The U.S. military continues to station and deploy forces forward, “assuring access to overseas regions, defending key interests in those areas, protecting [its] citizens abroad, and preventing [its] adversaries from leveraging the world’s oceans against” the United States.²

Recap

Forecasting the future, especially 15-30 years hence, is a challenge. Nevertheless, this MCSEF tackles the challenge by rigorously analyzing relevant patterns and trends, assessing the character of future conflict, and developing several plausible futures. Though projections of the deep future such as these may appear absurd, analyzing the future security environment—in many possible forms—is vital to plan and prepare responsibly for the day when the deep future is the all-too-real and undeniable present. Ultimately, it is improbable that one of the futures envisioned in this forecast will be the future. By offering an array of futures, however, the MCSEF serves as a tool that planners and decision makers can use to outfit the Marine Corps with a broad and adaptive capability set—one that will enable success in the face of whatever challenges the future does hold.

² U.S. Department of the Navy, *A Cooperative Strategy for 21st Century Seapower* (Washington, DC: U.S. Department of the Navy, 2015), 1.

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Chapter 1

Introduction

“Prediction is very difficult, especially if it’s about the future.”³

— Niels Bohr

Predicting the future is problematic. For this reason, ambiguity is the lifeblood of psychics, soothsayers, and all prognosticators for profit; it facilitates their “not being wrong.” Ambiguity, however, is not very useful in strategic planning. Moreover, humans seem to have an inexorable drive to make precise predictions.⁴ This trait apparently leads even the most accomplished, informed, and farsighted experts to cast prudence aside and offer bold predictions about the future.

During the infancy of computers and in particular personal computers, the future of computer technology was uncertain. Still, this did not discourage Ken Olsen, co-founder and chief executive officer of Digital Equipment Corporation (DEC), from famously asserting during a talk at a 1977 meeting of the World Future Society, “There is no reason for any individual to have a computer in his home.”⁵ Olsen was not apparently referring to personal computers, which would have been ironic and counterintuitive since DEC was a leading producer of the first successful predecessors to the personal computer. Instead, Olsen was talking about computers that would regulate features of the home such as lighting, temperature, and security systems. He was essentially dismissing what we now refer to as an “internet of things,”⁶ in which ADT, AT&T, Google, and Verizon, to name just a few, are today finding lucrative business opportunities.

³ Versions of this quotation have also been attributed to Yogi Berra (“It’s tough to make predictions, especially about the future”) and Samuel Goldwyn (“...never make predictions—especially about the future”), and some suggest Mark Twain originated the saying. See “Letters to the Editor: the inbox—The perils of prediction, June 2nd,” *The Economist*, 15 July 2007, http://www.economist.com/blogs/theinbox/2007/07/the_perils_of_prediction_june.

⁴ According to *The Economist*, “Humans are bad at factoring in the possibility of randomness and uncertainty. We forget about unpredictability when it is our turn to predict, and overestimate our own knowledge. When researchers asked a group of students to choose a range for the number of lovers Catherine the Great had had, wide enough to ensure that they had a 98% chance of being right, a staggering 45% of them got it wrong. Why didn’t they guarantee being correct by picking a range of none to ten thousand? After all, there were no prizes for keeping the range tight.” See “Uncertainty: The perils of prediction,” *The Economist*, 31 May 2007, <http://www.economist.com/node/9253918>.

⁵ Robert Strohmeier, “The 7 Worst Tech Predictions of All Time,” *TechHive*, 31 December 2008, http://www.techhive.com/article/155984/worst_tech_predictions.html and Matt Novak, “7 Famous Quotes About the Future That Are Actually Fake,” *Paleofuture*, 8 September 2014, <http://paleofuture.gizmodo.com/7-famous-quotes-about-the-future-that-are-actually-fake-1631236877>.

⁶ “Ken Olsen,” *Snopes*, 21 September 2004, <http://www.snopes.com/quotes/kenolsen.asp>.

Darryl Zanuck, movie producer for 20th Century Fox, displayed similar hubris decades earlier in 1946 when he predicted, "Television won't last because people will soon get tired of staring at a plywood box every night."⁷ Today's proliferation of popular reality television programs suggests that Zanuck should have resisted the temptation to forecast the future even in his own industry.

Still, not all predictions are fodder for Internet "10 worst" lists. More than a century in advance, one observant political theorist, historian, and sociologist foresaw an epic struggle between two great powers that would affect the world for an era. In 1840, Alexis de Tocqueville wrote in *Democracy in America*, "There are now two great nations in the world, which starting from different points, seem to be advancing toward the same goal: the Russians and the Anglo-Americans....Each seems called by some secret design of Providence one day to hold in its hands the destinies of half the world."⁸ Today, many regard Tocqueville as having accurately forecast the Cold War with this observation. Had one or both nations subsequently acted upon this forecast and prepared for the eventual struggle, the course of history might have been different—perhaps the Cold War would have ended sooner or occurred not at all.

Purpose

The MCSEF is fundamentally a document for planners and decision makers. It surveys the trends, drivers, cycles, uncertainties, and even choices that will shape the set of plausible futures. Its purpose is not to predict the future precisely, for the future is unknowable. Instead, the MCSEF aims to:

- Identify and analyze the principal patterns and trends shaping the future security environment;
- Describe and assess plausible future security environments;
- Generate ideas that inform the development and implementation of institutional concepts, capabilities, and requirements;
- Offer recommendations for service consideration to guard against strategic surprise, shape the future force, and stimulate thought; and,
- Inform senior leadership's vision of the future.

Scope

This forecasting effort is multidisciplinary and global in scope. It explores patterns, trends, action, and interaction in social, technological, economic, environmental, and political domains, and it considers activities by and relationships among state and non-state actors at the subnational,

⁷ Ashley Lutz, "20 Predictions From Smart People That Were Completely Wrong," *Business Insider*, 2 May 2012, <http://www.businessinsider.com/false-predictions-2012-5?op=1>.

⁸ Alexis de Tocqueville, *Democracy in America*, ed. Eduardo Nolla and trans. James T. Schleifer (Indianapolis, IN: Liberty Fund, 2010), 2:655-656.

national, and supranational levels. The forecast focuses on the security environment during the period 2030 to 2045.

Method

Futures Assessment Division (FAD) draws on the “Framework Foresight” method for completing foresight projects developed at the University of Houston.⁹ Framework Foresight is a structured but flexible approach to forecasting. It begins by describing the domain, characterizing its present status, and reviewing the relevant recent past. Next, the method identifies the principal forces for change and uses these to develop multiple possible futures. Finally, it turns to exploring these futures to discover implications, issues, and opportunities.

Similarly, development of the MCSEF begins by conducting a comprehensive, multidisciplinary survey of current patterns and trends as reflected in a wide range of literature. The objective is to uncover common patterns and trends identified by a variety of national and multinational institutions, agencies, and organizations. This body of literature, much of it future-oriented, includes works and products from a diverse set of organizations and sources:

- National Intelligence Council (e.g., *Global Trends 2015, 2020, 2025, and 2030*);
- U.S. Department of Defense (e.g., *Quadrennial Defense Review 2014*);
- U.S. Department of State (e.g., *Quadrennial Diplomacy and Development Review 2010*);
- U.S. Marine Corps (e.g., MCI’s *Future Operating Environment 2015-2025: Implications for Marines*);
- U.S. Army (e.g., published results of Unified Quest workshops for 2012 and 2014);
- Multinational partners (e.g., futures assessments from NATO, U.K. Ministry of Defence, Australian Army);
- United Nations (e.g., *World Population Prospects, World Urbanization Prospects, World Economic and Social Survey*);
- Multinational organizations (e.g., World Bank’s *Global Economic Prospects*, International Monetary Fund’s *World Economic Outlook*);
- Multinational corporations (e.g., Royal Dutch Shell, PricewaterhouseCoopers, HSBC);
- Respected journals and periodicals (e.g., *Foreign Affairs, International Security, Science, The Economist, The Futurist*);
- Respected experts and authors (e.g., Kilcullen, Friedman, Zakaria).

Additional independent research and analysis augments this extensive literature review, for as Royal Dutch Shell, one of the earliest innovators in strategic foresight, notes, “Any meaningful exploration of possible future landscapes inevitably highlights alternative features or patterns.”¹⁰

⁹ Andy Hines and Peter C. Bishop, “Framework foresight: Exploring futures the Houston way,” *Futures* 51 (2013): 31-49.

¹⁰ Shell Scenario Team, *New Lens Scenarios: A Shift in Perspective for a World in Transition* (The Hague, NL: Shell International BV, 2013), 7.

This extensive research and analysis generates an informed assessment of the most relevant global patterns and trends that will influence the security environment beyond 2030.

Building on the exploration of patterns and trends, the next step in the foresight process involves the development of several plausible futures, beginning with the “baseline” future. The baseline future is a description of a plausible deep future based on the extrapolation of long-range trends, cycles, and patterns. Analysis suggests a baseline future based on the factors selected and the anticipated rate of change over time. It is a starting point from which futurists develop plausible “alternative” futures that may occur. The baseline future also functions as a yardstick against which alternative and “preferred” futures can be measured to evaluate their suitability, likelihood, or rationality.

Next, futurists develop one or more alternative futures. Alternative futures are plausible futures that may occur due to reasonable alteration in long-term trends, cycles, and patterns. Those who develop an alternative future begin with the baseline future and select a plausible combination of factors to vary from their observed courses, extrapolating the results into a future that necessarily differs from the baseline future. For example, they might elect to alter a demographic or technological trend, evaluating how this would cause a future with different characteristics to evolve. The process requires a blend of creativity and judgment. While exclusively varying trends for the better would certainly make for an easy tomorrow, history suggests that such futures are unlikely, and, for purposes of the MCSEF, futures in which “everything works out” hold less value. Creating multiple alternative futures requires successive iterations of the process, selecting unique combinations of factors to vary each time. Having one or more alternative futures to analyze in addition to baseline and preferred futures enables planners to better prepare for the unknowable future that eventually occurs.

Finally, futurists describe one or more preferred futures, which often represent idealized futures not necessarily based on hard analysis. A preferred future derives from institutional culture and momentum; it can be politically, culturally, or programmatically driven, and it usually represents an orthodox consensus future. It typically emerges from past practices, stakeholder interests, and the competition for national, institutional, or corporate resources. The preferred future is possible, but it is often less plausible and less likely than alternatives based on independent analysis. However, in the national security arena, history often reflects a tendency to pursue unrealistic futures in an effort to maintain cherished programs and methods or to concentrate on improving capabilities to fight the last war.

Organization

This forecasting effort begins in chapter 2 with a survey and analysis of patterns and trends judged most relevant to the future security environment. This effort examines these patterns and trends in seven groups: demographics, technology, resource competition, environmental stress, globalization, governance, and urban littorals. Considering how the relevant patterns and trends will influence the future, chapter 3 then describes the character of future conflict, highlighting what will change about

conflict in the future and what will remain the same. This discussion in no way suggests that the timeless nature of war will change; instead, it foresees changes to the features and methods of warfare.

Next, the MCSEF describes several plausible futures set in the 2030-2045 timeframe. Chapter 4 describes the baseline future, derived simply by extending today's observable patterns and trends into the future based on their current evolution. Chapter 5 posits a pair of alternative futures, which could emerge assuming select groups of patterns and trends alter their evolutionary tracks as a result perhaps of random events or human action. In the context of current patterns and trends, chapter 6 explores the preferred future as reflected in the Nation's strategy and policy documents.

Finally, the MCSEF concludes in chapter 7 with a review of main lessons drawn from the forecasting effort and discussion of its proposed uses by planners and decision makers.

Chapter 2

Patterns and Trends

“There are only patterns, patterns on top of patterns, patterns that affect other patterns. Patterns hidden by patterns. Patterns within patterns. If you watch close, history does nothing but repeat itself. What we call chaos is just patterns we haven't recognized. What we call random is just patterns we can't decipher. What we can't understand we call nonsense. What we can't read we call gibberish.”

— “Tender Branson” in the novel *Survivor* by Chuck Palahniuk

Overview

As mentioned in the preceding chapter, forecasting, whether it pertains to the economy, weather, or security environment, is a challenging endeavor. Some label it a fool's errand. It is nevertheless a useful “errand” because it helps in preparing for the future, and forecasting is useful if it helps individuals and organizations develop the knowledge, skills, and abilities to cope with whatever the future ultimately throws at them. Various forecasting methods have developed over time,¹¹ and most rely on recognition and analysis of past and present patterns and trends. As noted 20th century American economist Sylvia Porter once observed, “One of the soundest rules I try to remember when making forecasts...is that whatever is to happen is happening already [emphasis added].”¹² This security environment forecast begins, therefore, with a survey and analysis of the patterns and trends that appear most relevant to the future security environment.

Identification and analysis of patterns and trends provide the foundation for this forecast. Horizon scanning, research, and analysis have produced a lengthy list of candidates, grouped into seven categories: demographics, technology, resource competition, environmental stress, globalization, governance, and urban littorals. Within this chapter, discussion of the most relevant patterns and trends proceeds from those with more uniform, fundamental characteristics (e.g., demographics and technology) to those that are more multiform, multidisciplinary, and complex (e.g., globalization and governance). The chapter culminates with a discussion of patterns and

¹¹ Most generally, there are quantitative and qualitative methods that can be further grouped into at least five categories. See David S. Walonick, “An Overview of Forecasting Methodology,” *StatPac*, accessed 11 May 2015, <http://www.statpac.org/research-library/forecasting.htm> and John C. Chambers, Satinder K. Mullick, and Donald D. Smith, “How to Choose the Right Forecasting Technique,” *Harvard Business Review*, accessed 11 May 2015, <https://hbr.org/1971/07/how-to-choose-the-right-forecasting-technique>.

¹² Sylvia Porter, as quoted in Center of Excellence for Information and Computing Technology, *Emerging Workforce Trends in Information and Computing Technology, 2011 to 2018* (Bellvue, WA: Bellvue College, 2011), 5.

trends relating to the urban littorals, which are rapidly emerging as some of the most complex and challenging operating environments.

Demographics

Demographic patterns and trends are normally stable, offering a good basis for forecasting. Absent major disruptive global or regional events widely affecting the human population, changes in demographic trends—and their consequences—unfold relatively gradually and predictably. As a result, forecasts based on demographic trends tend to be reliable. This section surveys and summarizes the leading demographic estimates and forecasts¹³ with a focus on their implications for the future security environment. Overall, it reveals that several well-anchored demographic trends appear to support emergence of a more stable, less conflict-prone future security environment by the middle of the century, with demographic trends contributing little to erosion of the position of the United States relative to other nations.

Current State

In 2013, the world population reached 7.2 billion, with over 80 percent living in developing countries. The world population is relatively concentrated; in fact, just 10 countries, most of them still developing, contain more than half of the world population. Together, China and India account for 37 percent, and the United States, Indonesia, Brazil, Pakistan, Nigeria, Bangladesh, Russia, and Japan account for another 22 percent. Of the 233 countries and areas whose populations the United Nations tracks separately,¹⁴ 75 percent account collectively for just 10 percent of the world population.¹⁵ The world population is still increasing, but after a period of accelerating population growth during the middle of the 20th century, the rate of population growth is declining. This shift is largely a result of declining fertility in the developing world, although this remains where the majority of population growth will occur.¹⁶

¹³ This section relies substantially on the demographic statistics of the United Nations, Department of Economic and Social Affairs, Population Division, which is widely regarded as the authority on the collection, development, and analysis of global demographic data, estimates, and forecasts. For example, a RAND study notes: “UN numbers are considered to be the ‘gold standard’ in the world of demographic projections. According to the National Research Council’s (NRC’s) *Beyond Six Billion*, Washington, DC: National Academy Press, 2000, U.N. projections for year 2000 population have been at no time off by much more than 7 percent, even going as far back as 1957 (see ‘The Accuracy of Past Projections,’ in NRC, 2000, pp. 37–52).” *World Population Prospects: The 2012 Revision, Highlights and Advance Tables* serves as a principal source, complemented by several other demographic analyses produced by the United Nations, government agencies, and academic institutions.

¹⁴ United Nations, Department of Economic and Social Affairs, Population Division, *World Population Prospects: The 2012 Revision, Highlights and Advance Tables* (New York: United Nations, 2013), vii-xiii and 2-3.

¹⁵ *Ibid.*, 2-3.

¹⁶ *Ibid.*, 3.

As the bulk of the world population has shifted geographically toward the developing world,¹⁷ it has also “aged” due to declining rates of fertility and mortality. The share of the world population over age 60 is 12 percent (2013), up from 8 percent (1950). By 2013 in the more developed regions, the proportion of older persons surpassed that of children (23 percent versus 16 percent).¹⁸ In the less developed regions,¹⁹ the proportion of children declined from 38 percent in 1950 to 28 percent in 2013, while the proportion of older persons increased from 6 percent to 9 percent. Viewed from another perspective, the world’s median age is 29 (2013), up from 24 (1950), and the median age is significantly higher in every region of the world except Africa where the current median age is virtually unchanged from a half century ago at 19 (2013).²⁰

As mentioned, both fertility and mortality rates have declined. Worldwide, total fertility—that is, the average number of children a woman would bear if fertility rates remained unchanged during her lifetime—stands at 2.53 children per woman during the most recently estimated period of 2005-2010. This is lower than the rate of 5.02 children per women when the rate peaked during 1960-1965. For 2005-2010, total fertility for the more developed regions is 1.66; for the less developed regions, 2.69; and for the least developed regions, 4.53.²¹ Compared to 1960-1965, total

¹⁷ The terms “developed” and “developing,” with “developing” often further subdivided into “less developed” and “least developed,” are based on a specific taxonomy used by the United Nations. The United Nations uses the Human Development Index (HDI) to capture the multifaceted nature of development. The HDI is a composite index of three indices measuring countries’ achievements in longevity, education, and income. The development threshold is the 75th percentile in the HDI distribution. See “Human Development Index (HDI),” *United Nations Development Programme*, accessed 1 May 2015, <http://hdr.undp.org/en/content/human-development-index-hdi> and United Nations Development Programme, *Human Development Report 2014—Sustaining Human Progress: Reducing Vulnerabilities and Building Resilience* (New York: United Nations Development Programme, 2014), 160-163. For a concise discussion of the UN taxonomy as compared with others, see Lynge Nielsen, *Classifications of Countries Based on Their Level of Development: How it is Done and How it Could be Done* (WP/11/31) (Washington, DC: International Monetary Fund, 2011), 3-9 and 19.

¹⁸ According to the United Nations Population Division, “More developed regions comprise all regions of Europe plus Northern America, Australia/New Zealand, and Japan.” This report alternately refers to countries or areas in the more developed regions as “developed countries.” See United Nations, *World Population Prospects: The 2012 Revision*, vii.

¹⁹ According to the United Nations Population Division, “Less developed regions comprise all regions of Africa, Asia (excluding Japan), and Latin America and the Caribbean as well as Melanesia, Micronesia and Polynesia.” This report alternately refers to countries or areas in the less developed regions as “developing countries.” See United Nations, *World Population Prospects: The 2012 Revision*, vii.

²⁰ By convention, the United Nations normally refers to “older persons” as those age 60 and older and to “children”—or “younger persons”—as those who are under age 15. See United Nations, *World Population Prospects: The 2012 Revision*, 6-9. Not all demographers adhere precisely to this convention, although the differences are not dramatic. This section of the MCSEF will also later capitalize on the work of demographers who group the population slightly differently, defining younger persons as those who are age 20 and younger; “working-age” persons, between ages 20 and 60; and older persons, age 60 and older.

²¹ This discussion of demographics employs the United Nations taxonomy for classifying regions and countries. According to the United Nations, “The designation ‘more developed’ and ‘less developed’ regions are intended [sic] for statistical purposes and do not express a judgment about the stage reached by a particular country or area in the development process. The term ‘country’ as used in this publication also refers, as appropriate, to territories or areas. More developed regions comprise all regions of Europe plus Northern America, Australia/New Zealand, and Japan. Less developed regions comprise all regions of Africa, Asia (excluding Japan), and Latin America and the Caribbean as well as Melanesia, Micronesia, and Polynesia. Countries or areas in the more developed regions are designated as ‘developed countries’. Countries or areas in the less developed regions are designated as ‘developing countries’.” According to the United Nations, “The least developed countries, as defined by the United Nations General Assembly...included 49 countries in

(note continued)

fertility is currently lower in every region, although total fertility for North America has stabilized at approximately 2.00 during the past two decades. Declining mortality has accompanied declining fertility. Life expectancy for the world population is 69 years (2005-2010), up from about 47 years a half century earlier, and it is higher in every region of the world except Eastern Europe, particularly the Russian Federation and Ukraine.²²

The working-age population also merits attention because it is an important and reliable indicator of national power. As the United Nations Population Division notes, “Trends in the number of persons of working age (those aged 15 to 59 years) are particularly important for all countries. The proportion of the population in those ages is an important factor related to the potential for economic growth.”²³ In the 20th century, following a brief post-war decline, the proportion of the population that is working age in the developed countries increased steadily, peaking at 63 percent in 2005. Based on the most recent estimates in 2013, this proportion is 61 percent for both developed and developing countries, though only 55 percent for the subset of the 49 least developed countries.²⁴

Principal Patterns and Trends

The United Nations produces a range of world population forecasts (high, low, and medium variants) based on different assumptions relating to fertility, mortality, and migration. In the most recent *World Population Prospects: The 2012 Revision*, the medium-variant forecast projects a world population growing to 8.4 billion by 2030 with the following general features:

- The majority of population growth will occur in less developed regions.
- The population of the more developed regions collectively will remain largely unchanged at 1.3 billion inhabitants, with these regions avoiding population decline mostly due to migration.
- The world population share of less developed regions will rise to 85 percent (2030) from 83 percent (2013), and the share of the 49 least developed countries will rise to 15 percent (2030) from 13 percent (2013).

The populations of both Asia and Africa will continue to grow through the forecast period (2030-2045). India will surpass China by 2030 as the world’s most populous country, but together their share of world population will decline to 33 percent (from 37 percent in 2013). Five of the least developed countries—Bangladesh, Ethiopia, Uganda, Tanzania, and the Democratic Republic of the

June 2013: 34 in Africa, 9 in Asia, 5 in Oceania, and one in Latin America and the Caribbean....These countries are also included in the less developed regions.” For the complete list, see United Nations, *World Population Prospects: The 2012 Revision*, vii.

²² Ibid., 12.

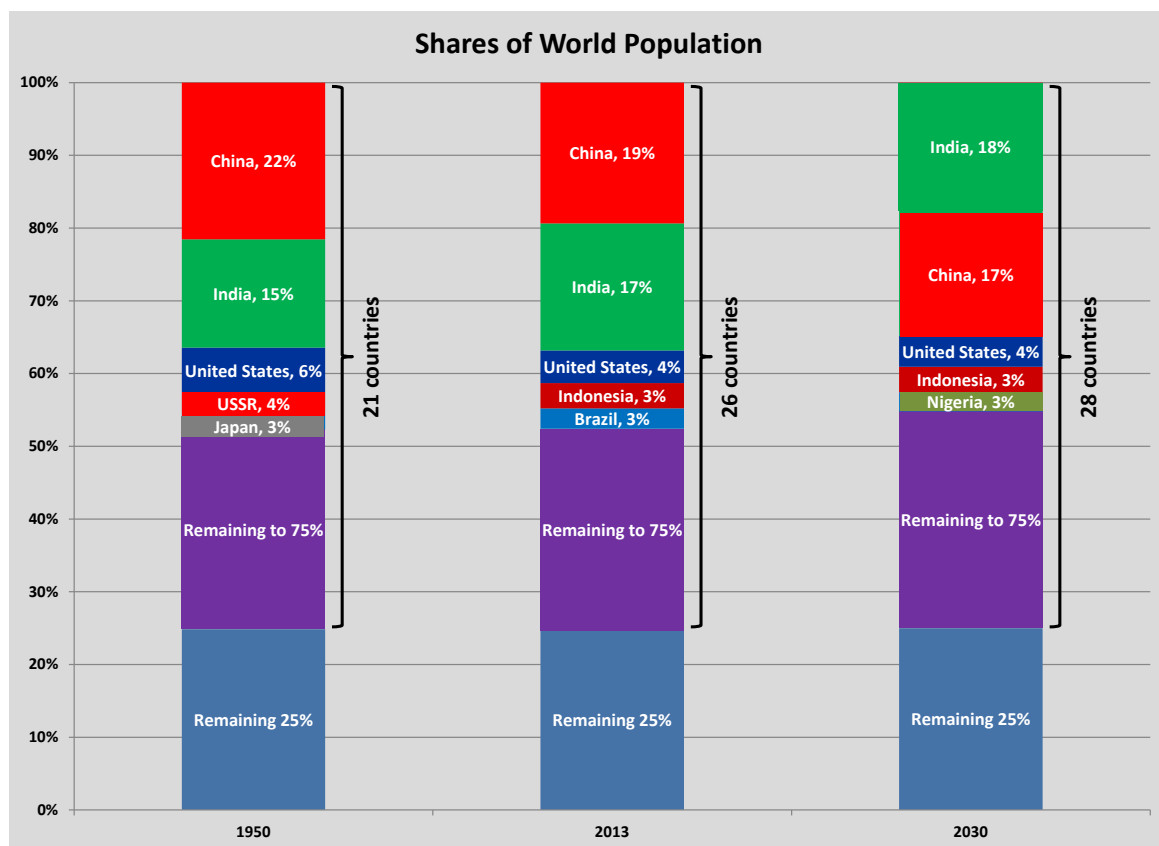
²³ Ibid., 8. It is worth highlighting again that different demographers, analysts, and institutions employ slightly different taxonomies relating to age when analyzing populations. For the United Nations, working age begins at age 15 and ends at 59. For others, it begins at age 20. Some analysts also end the working age cohort at 64. These differences do not appear to yield significantly different analytic results.

²⁴ Ibid., 8-9.

Congo—will make the list of the 25 most populous countries by 2030. On a global level, the annual rate of population growth will continue to slow from 1.20 percent (2005-2010) to 0.66 percent (2035-2040).²⁵ Overall, five significant patterns and trends dominate the changing world demographics: (1) continuing global diffusion of the population; (2) urbanization; (3) migration; (4) aging, with a pair of significant internal characteristics to the aging trend; and (5) the development and/or dissipation of “youth bulges” in certain regions.

Population Diffusion. The world population is becoming more diffuse—or dispersed—and forecasts indicate this trend will continue at least through the end of this century. In 1950, just 21 countries accounted for 75 percent of the world population, so the world population was relatively concentrated at that point. Based on 2013 estimates, 26 countries currently compose that same 75 percent of the world population and forecasts indicate that by 2030 this figure will rise to 28 countries (see figure 2-1). Viewed another way, the world’s most populous country, China, currently

Figure 2-1. Diffusion of the World Population



Data Source: United Nations, Department of Economic and Social Affairs, Population Division, *World Population Prospects: The 2012 Revision* (ESA/P/WP.228), “File POP/1-1: Total population (both sexes combined) by major area, region and country, annually for 1950-2100 (thousands).”

²⁵ Ibid., 1-3.

accounts for 19 percent (2013) of the world population, down from 22 percent (1950). The United Nations forecasts that India will have displaced China as the world's most populous country by 2030, but at that point India will account for only 18 percent of the world population. Moreover, in 1950 developed countries accounted for approximately a fourth of this 75-percent slice of the world population. They represent just a seventh today, and the United Nations forecasts that today's developed countries will account for just a tenth of this 75-percent slice by 2040.²⁶ Therefore, as the world population disperses across a greater number of countries, the direction of this dispersion is toward the world's less developed regions.

Urbanization Continues. Juxtaposed against this diffusion of the world population is a second demographic trend: urbanization.²⁷ Seemingly contradictory, the two trends of diffusion and urbanization are nonetheless compatible. Differing fertility and mortality rates, coupled with changing international migration patterns (addressed below), are reducing the concentration of the world's population when viewed globally by country. However, within countries, populations are concentrating in the urban areas due to higher urban fertility, lower urban mortality, and domestic migration patterns. According to the United Nations, the share of the world population categorized as urban was 52 percent in 2011, up from 30 percent in 1950; the forecast is 60 percent by 2030. The urbanization trend is positive for both more developed regions (55 percent urban in 1950; 78 percent, 2011; and 82 percent, 2030) and less developed regions (18 percent urban in 1950; 47 percent, 2011; and 56 percent, 2030), although the rate of urbanization is decreasing.²⁸

International Migration Stabilizes. Third, international migration increased for most of the 20th century, but based on current estimates it appears to have peaked in the period 2000-2010 at approximately 3.5 million net international migrants.²⁹ Because the movement of people across international boundaries is a function of changing and often unpredictable socio-economic, environmental, and political factors—and because there are both documented and undocumented migrants—international migration is the most difficult demographic variable to estimate and forecast. Still, the UN forecasts that net international migration from less developed regions to more developed regions will decline gradually from the current figure and stabilize later this century. Net migration will decline comparably across less developed regions during the forecast period, although Asia will eventually experience an increasing portion of the decline during the latter half of the century. There is broad consensus that domestic migration to the urban areas will continue.

²⁶ Ibid., 61-62.

²⁷ For a more complete discussion of urbanization, see the section on “Urban Littorals.”

²⁸ United Nations, Department of Economic and Social Affairs, Population Division, *World Urbanization Prospects: The 2011 Revision, Highlights* (New York: United Nations, 2012), 2-4. For additional context, see National Intelligence Council, *Global Trends 2030: Alternative Worlds* (Washington, DC: U.S. Government Printing Office, 2012), 27-30, which can be found at www.dni.gov/nic/globaltrends, and Mark R. Montgomery, “Cities Transformed: Demographic Change and Its Implications in the Developing World” (briefing, Stony Brook University, 2007), 13-23.

²⁹ United Nations, *World Population Prospects: The 2012 Revision*, 21.

It is important here to acknowledge an opposing view concerning international migration trends. The U.S. National Intelligence Council (NIC) offers another perspective: “We will not see the same high proportion of migrants as in the first industrial revolution, but international migration is set to grow even faster than it did in the past quarter-century. The factors promoting cross-border migration are likely to remain strong or intensify. These factors are globalization, disparate age structures across richer and poorer countries, income inequalities across regions and countries, and the presence of migrant networks linking sending and receiving countries.”³⁰ This lack of consensus on international migration trends no doubt reflects the substantial estimating and forecasting challenges already discussed.

Widespread but Varied Aging. Fourth, the world population is aging, although this process is not uniform across all regions. The United Nations forecasts that by 2030 the median age of the world population will be 33 years, up from 29 in 2013. The world population, however, will not age evenly. By 2030, over 60 countries will have a median age above 40 years, with more than half of these in the developing world. In contrast, 32 of 55 countries whose median ages will remain below 25 years in 2030 will be among the 49 least developed countries, and most will be located in Africa.³¹ Within this generalized aging trend, there are two noteworthy traits: an increasing elderly population that is most pronounced in the developed economies and an increasing working-age population in selected developing economies. By 2030, the share of the world population over age 60 will reach 16 percent, compared to the current figure of 12 percent (2013) (figure 2-2). However, in 2030 the share of older persons in the developed regions is expected to be almost double that of children (29 percent versus 16 percent), which stands in clear contrast to the 2013 ratio for more developed regions (23 percent versus 16 percent) and to the comparable ratio in 2030 for the less developed regions (14 percent versus 25 percent). As world

Figure 2-2. Global Population Aging

Youthful and Elderly Shares of Total Population by Age Cohort

	Age Cohort	1950	2013	2030	2040
Global	<15	34%	26%	24%	22%
	>60	8%	12%	16%	19%
Developed World	<15	28%	16%	16%	16%
	>60	11%	23%	29%	31%
Developing World	<15	38%	28%	25%	23%
	>60	6%	9%	14%	17%

Data Source: United Nations, Department of Economic and Social Affairs, Population Division, *World Population Prospects: The 2012 Revision* (ESA/P/WP.228), “File POP/9-1: Percentage total population (both sexes combined) by broad age group, major area, region and country, 1950-2100.”

³⁰ National Intelligence Council, *Global Trends 2030*, 24-27. For consistency, this report adheres to the United Nations view, as the United Nations Population Division is widely regarded as the authority on demographic estimating and forecasting.

³¹ United Nations, *World Population Prospects: The 2012 Revision*, 6-8.

population aging swells the ranks of those over age 60, particularly in the more developed regions, it will also increase the relative size of the working-age population in the 49 least developed countries. According to United Nations forecasts, the working-age population as a share of the total population in the least developed countries will increase from 55 percent (2013) to 60 percent (2030), due mostly to a decline in children as a share of the total population from 40 to 33 percent in this same period.³²

Youthful Populations Rise and Decline Regionally. Finally, “youth bulges”³³ continue to punctuate the global demographic landscape, as they develop in some areas and dissipate in others. Political scientists and demographers suggest that the existence of youth bulges in particular regions or countries makes them more susceptible to the onset of political strife and violence.³⁴ Projections of youth bulges are therefore relevant for the future security environment. Based on United Nations population forecasts and scholarly research on youth bulges, the world’s least developed countries, in general, will continue to experience youth bulges throughout the period 2030-2045, although their size will decline continuously over the period (see figure 2-3). United Nations forecasts indicate that youth bulges will persist during 2030-2045 on a regional basis only in sub-Saharan Africa (including Eastern, Central, and Western Africa). By 2030, region-wide youth bulges will have generally dissipated in Northern Africa, Southern Africa, Eastern Asia, Central Asia, Western Asia, Southern Asia, Southeastern Asia, Oceania,³⁵ Central America, South America, and the Caribbean, although a few countries within these regions will continue to experience youth bulges of varying degrees. Forecasts suggest that during the period 2030-2045 the most pronounced youth bulges—those whose relative size places them in the top 10 percent—will persist in Burundi, Malawi, Mozambique, Somalia, Uganda, Tanzania, Zambia, Angola, Chad, Gambia, Mali, Niger, Nigeria, Afghanistan, and East Timor.

³² Ibid., 7-9.

³³ Demographers have not agreed on a single definition of the term “youth bulge.” Generally, however, a youth bulge is a demographic phenomenon in which there is an unusually large cohort of young people relative to either the adult or working-age population. Some define “young people” as those ages 15 to 29; others use the age group 15-24. See, for example, Christian G. Mesquida and Neil I. Wiener, “Male Age Composition and Severity Of Conflicts,” *Politics and the Life Sciences* 18, no. 2 (1999): 181-189; Jack A. Goldstone, “Population and Security: How Demographic Change Can Lead to Violent Conflict,” *Journal of International Affairs* 56, no. 1 (2002): 3-22; Sean O’Brien, “Anticipating the Good, the Bad, and the Ugly: An Early Warning Approach to Conflict and Instability Analysis,” *Journal of Conflict Resolution* 46, no. 6 (2002): 791-811; Richard P. Cincotta, Robert Engelman, and Daniele Anastasion, *The Security Demographic: Population and Civil Conflict After The Cold War* (Washington, DC: Population Action International, 2003); and Henrik Urdal, *The Devil in the Demographics: The Effect of Youth Bulges on Domestic Armed Conflict, 1950-2000* (Washington, DC: World Bank, 2004).

³⁴ See Goldstone, “Population and Security,” *Journal of International Affairs*, 3-22; Richard P. Cincotta, “Demographic Security Comes of Age,” *Environmental Change and Security Program Report, Issue 10, 2004*, ed. Geoffrey D. Dabelko (Washington, DC: Woodrow Wilson International Center for Scholars, 2009), 24-29; Sarah Staveteig, “The Young and the Restless: Population Age Structure and Civil War,” *Environmental Change and Security Program Report, Issue 11, 2004*, ed. Geoffrey D. Dabelko (Washington, DC: Woodrow Wilson International Center for Scholars, 2009), 12-19; and Henrik Urdal, “A Clash of Generations? Youth Bulges and Political Violence,” *International Studies Quarterly* 50, no. 3 (2006): 607-629.

³⁵ According to the United Nations definition, Oceania includes Australia, New Zealand, Melanesia, Micronesia, and Polynesia.

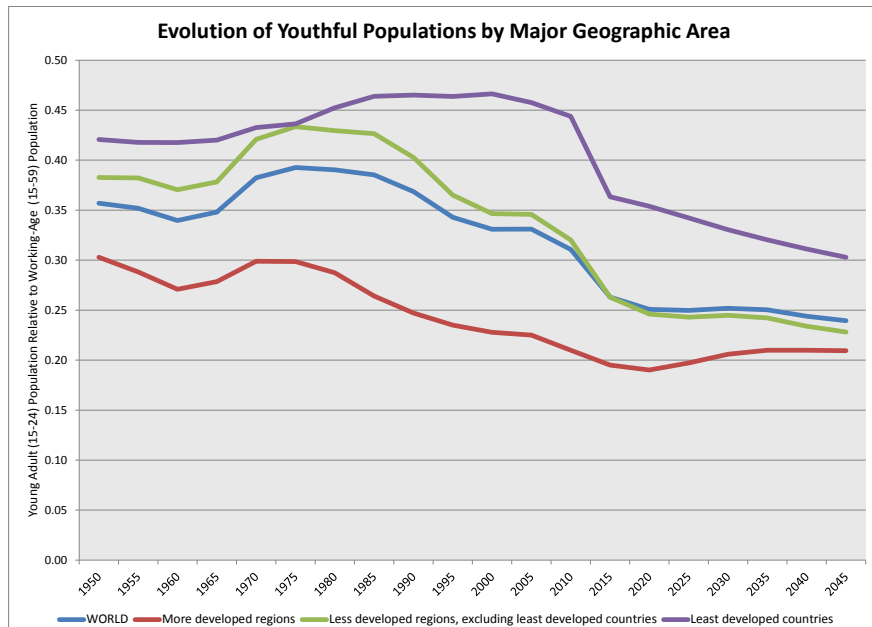
Implications

Scholars have determined working-age population to be the most relevant demographic factor when assessing the implications of demographic patterns and trends for national power, military power, and by extension the security environment. Libicki, Shatz, and Taylor state plainly: “Working-age populations are what determine the demographic component of national power. The contribution from those under 20 or over 60 tends to be relatively small” and is not likely to influence analytical results or conclusions.³⁶ The working-age population encompasses the vast majority of (1) those eligible for military service; (2) those contributing directly to a national economy’s output; and (3) those developing, integrating, and maintaining a nation’s technical expertise and capability. Analysis of trends and forecasts for the working-age population, therefore, reveals several probable impacts and implications for national power, military power, and the security environment.

First, the current demographic patterns and trends do not appear to signal a significant change (either increase or decrease) in the risk of widespread conflict. Some have argued that population growth alone leading to intense resource competition and severe environmental degradation—essentially, the Malthusian

sources of potential conflict—will increase the risk and frequency of armed conflict. However, there are few examples of population growth directly causing armed conflict, save perhaps some isolated instances in Africa. Trends in economic development and declining fertility (see figure 2-4) also “make this a receding threat, albeit still relevant for Africa.”³⁷ Aging will change the shape of populations in both more and less developed regions. Aging in the more developed regions—a

Figure 2-3. Youth Bulges Continue but Decline



Data Source: United Nations, Department of Economic and Social Affairs, Population Division, *World Population Prospects: The 2012 Revision* (ESA/P/WP.228), “File POP/9-1: Percentage total population (both sexes combined) by broad age group, major area, region and country, 1950-2100.”

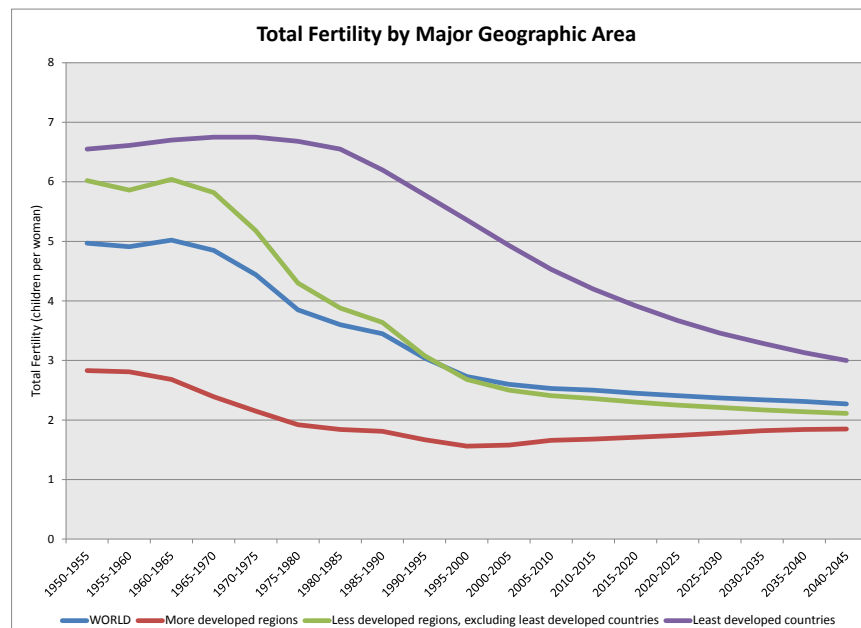
³⁶ Martin C. Libicki, Howard J. Shatz, and Julie E. Taylor, *Global Demographic Change and Its Implications for Military Power* (Santa Monica, CA: RAND Corporation, 2011), xiii. Note that these researchers define working age as 20-60, as opposed to 15-59 used by the United Nations. See pp. 8-9 of the RAND document for a discussion of the significance of the working-age population for national power and for the complete rationale concerning beginning working age at 20 versus 15.

³⁷ *Ibid.*, 84.

looming “pensioner bulge”—is a significant social concern, as the elderly draw more heavily on public resources to fund pensions and health care in competition with resources for other spending including national defense.³⁸ Furthermore, aging in developed countries will tend to reduce working-age populations, reducing in turn their national power potential relative to countries with stable or growing working-age populations. Meanwhile, there is not strong evidence that developing nations will “suffer from a destabilizing youth bulge—specifically, a growing share of the population composed of males between the ages of 15 and 25,”³⁹ although some countries may experience

brief periods of increased vulnerability to intra-state conflict. As Libicki, Shatz, and Taylor note, “Demographic pressures, particularly working through economic motives and strong states, nevertheless, do not provide a very plausible set of *casus belli*. Most recent quarrels have arisen from the dysfunctions of weak states. Even for them, the link between economic or material motives and war is less important than unresolved differences over ethnic or religious identity.”⁴⁰ Ultimately, demographic trends interact with conflict

Figure 2-4. Declining Global Fertility



Data Source: United Nations, Department of Economic and Social Affairs, Population Division, *World Population Prospects: The 2012 Revision* (ESA/P/WP.228), “File FERT/4: Total fertility by major area, region and country, 1950-2100 (children per woman).”

more indirectly by shaping political, economic, ethnic, and religious factors, which have a much stronger direct influence on the incidence of conflict. Demographic trends appear to affect more often how states will respond to conflict—influencing, for example, whether or not a nation-state will favor diplomacy over a resort to arms—than how often they will become involved in conflict.

Second, current trends suggest the world’s areas prone to conflict due indirectly to demographic pressures will diminish, being concentrated instead in just a few regions. Empirical evidence suggests areas of low or declining birthrates, which describes most developed and developing regions in the coming decades, are likely to become more stable and less prone to

³⁸ Ibid., 77-80.

³⁹ Ibid., xvi.

⁴⁰ Ibid., 87.

conflict.⁴¹ Based on demographic trends through the middle of the century, the regions that will be most unstable and most vulnerable to future conflict include equatorial sub-Saharan Africa, Central through Southern Asia, and pockets in Eastern Asia because birthrates in these regions will not decline as fast or as much. Southeastern Asia will remain unsettled in the short-term, but demographic trends there suggest increasing stability toward the middle of the century. If conflict persists in Southeastern Asia beyond 2030, it will likely result from ongoing political, ethnic, or religious factors despite the demographic trends.

Third, demographic trends will not appreciably constrain U.S. ability to play a leading role in the future security environment. In fact, the U.S. is likely to grow more dominant within its current alliances. Among richer nations, only the United States has a birthrate that will sustain its population. The U.S. working-age population “is likely to constitute a growing percentage of the total manpower of the Atlantic alliance (essentially NATO) and the Pacific alliances (Australia, New Zealand, Japan, South Korea, and Taiwan).”⁴² Furthermore, absent a clear and present existential threat, contributions to collective defense from U.S. allies are likely to continue to decline.⁴³ With demographic trends potentially driving the United States to bear a greater collective defense burden relative to its traditional allies—and sharing values and interests with several developing countries—the U.S. may benefit by adding to its alliances and partnerships. As Libicki, Shatz, and Taylor remark, “A growing recognition that the United States and many emerging countries share enough of the same values coupled with our willingness to share global leadership with them (as we now do with current allies) could be helpful.”⁴⁴ This all suggests that investing significant future resources to achieve interoperability with small, aging nations within current alliances may offer limited return, as these nations will have shrinking populations, low gross domestic product (GDP) growth, and thus be able to contribute only minimally to collective defense. Efforts to develop “cultural intelligence” on and interoperability with non-traditional but like-minded partners may be more fruitful.

Fourth, scholarly research finds a correlation (but not direct causation) between youth bulges and increased risk of domestic armed conflict, terrorism, and riots or violent demonstrations, although other factors, including level of development and regime type, appear to provide more direct explanations of violence.⁴⁵ Additional research finds that, as youth bulges dissipate, liberal democracy has a significantly better chance of emerging. Specifically, when the share of young people (ages 15 to 29) contained in the working-age population (ages 15 to 64) drops below 40 percent, liberal democracy—accompanied by a relative decline in political violence—is more likely to flourish. When this measure of a youth bulge is above 40 percent, authoritarian regimes and poor

⁴¹ Ibid., 117-119.

⁴² Ibid., 114.

⁴³ There is evidence that this consequence of demographic and economic trends is already manifesting itself. See, for example, Griff Witte, “U.K.’s shrinking military clout worries U.S.,” *The Washington Post*, 12 March 2015, http://www.washingtonpost.com/world/europe/behind-tough-british-bark-on-russia-and-islamic-state-is-very-little-bite/2015/03/12/ae63a442-c727-11e4-bea5-b893e7ac3fb3_story.html?hpid=z1.

⁴⁴ Libicki, Shatz, and Taylor, *Global Demographic Change and Its Implications for Military Power*, 115.

⁴⁵ Urdal, “A Clash of Generations? Youth Bulges and Political Violence,” 607-629.

governance tend to persist, as does the increased prevalence of political violence.⁴⁶ Based on this measure, during 2030-2045, sub-Saharan Africa will remain the region most at risk for political violence that may demand international attention and perhaps the greatest source of manpower sustaining international terrorism. Specific countries whose youthful population as a share of the working-age population will remain above 40 percent for the duration of the period 2030-2045 include Afghanistan, East Timor, and an assortment of countries in sub-Saharan Africa.⁴⁷

Finally, based on demographic trends, U.S. power potential relative to competitors is uncertain. United Nations forecasts project that the U.S. working-age population will remain relatively constant as a share of its total population. The Russian population will age significantly and the working-age population will decline, which suggests diminishing global stature. However, absent liberalization in its political and economic environment, which might increase calls for more spending on non-defense programs, an authoritarian Russia appears likely to be able to focus resources on maintaining a position as a significant regional power. China's mid- to long-term future as a global power is less apparent based on demographics. The country's population, income, and productivity growth, if sustainable, suggest that China will surpass the U.S. For example, "China, with three times the population and comparable per capita income, would have three times the resources for military power than the United States."⁴⁸ However, population aging, governance challenges, and environmental degradation indicate China will be unable to sustain its recent trajectory. Plus, convergence theory⁴⁹ suggests that its growth rates will converge with those of developed economies. Under this scenario, China's GDP would probably surpass U.S. GDP, but its GDP per capita would lag, ultimately permitting China to approach only peer or near-peer competitor status with the United States.

Overall, key demographic trends ought to contribute to greater stability in the future security environment and a decline in the likelihood of conflict. Aging populations tend to be more peaceful, and well-established trends indicate that both developed and developing regions are aging, although at differing rates. The changing population compositions in both more developed and less developed countries should have a similar effect. In more developed countries (except the United States), the trends in fertility, mortality, and aging will lead to relative contraction of working-age populations and an increase in dependency ratios, which will generally tend to reduce human and financial resources available for military endeavors. In currently youthful, less developed

⁴⁶ Richard P. Cincotta, "Half a Chance: Youth Bulges and Transitions to Liberal Democracy," in *Environmental Change and Security Program Report, Issue 13, 2008-2009*, ed. Geoffrey D. Dabelko (Washington, DC: Woodrow Wilson International Center for Scholars, 2009), 10-18.

⁴⁷ The following countries in Africa will have youthful populations as a share of the working-age population that remain above 40 percent for the duration of the period 2030-2045: Burundi, Comoros, Kenya, Madagascar, Malawi, Mozambique, Somalia, South Sudan, Uganda, Tanzania, and Zambia in Eastern Africa; Angola, Cameroon, Chad, Congo, Democratic Republic of the Congo, and Sudan in Central Africa; and Benin, Burkina Faso, Ivory Coast, Gambia, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo in Western Africa.

⁴⁸ Libicki, Shatz, and Taylor, *Global Demographic Change and Its Implications for Military Power*, 116.

⁴⁹ "Convergence" describes the idea that all economies should eventually converge in terms of the major economic indicators, such as per capita income.

countries, the same trends will contribute to a relative expansion of working-age populations and a decrease in dependency ratios; here, however, the likely impact is less certain. If these nations can channel their expanding working-age populations into productive employment, reinforcing economic growth, then they create the potential to satisfy the needs of their populations and reduce the chances of instability and conflict; otherwise, the trend generates the potential for increased military power, internal tension, and possibly external adventurism. Ultimately, demographic patterns and trends do not influence the security environment in a vacuum, so their effects are more nuanced. Economic, political, ethnic, and religious factors weigh on the security environment as well, and some analysts foresee the potential for increased instability and conflict despite the dominant demographic trends.⁵⁰

Technology

In 2013, the Atlantic Council observed, “The world is on the cusp of another set of major technological transformations. Just as a teenager today has more computing power in the palm of her hand than NASA had when it launched Apollo 13..., the world of 2030 will feature surprises with benefits—and risks—we are only beginning to imagine.”⁵¹ Whether these major technological transformations lead to a third industrial revolution, as forecast by the Atlantic Council, or a different technological revolution, is uncertain. Recent technology forecasts do not take a uniform view of the particular technologies and/or combinations of technologies that will most influence the future, nor do they agree what they will most influence.⁵² Regardless, the vast majority of these forecasts concur that emerging technologies will significantly influence global economic, social, and military developments through 2030 and beyond.⁵³

Research into and analysis of “the significance in human affairs of the history of technology and the value of the contextual approach in understanding technical developments” have jelled into what are now known as “Kranzberg’s Laws”:⁵⁴

- Technology is neither good nor bad; nor is it neutral.
- Invention is the mother of necessity.
- Technology comes in packages, big and small.
- Although technology might be a prime element in many public issues, nontechnical factors take precedence in technology-policy decisions.
- All history is relevant, but the history of technology is the most relevant.

⁵⁰ The National Intelligence Council, for example, foresees demographic, economic, political, social, ethnic, religious, and technological trends combining to produce declining intra-state conflict, rising interstate conflict, and wider regional instability. See National Intelligence Council, *Global Trends 2030*, 62-85.

⁵¹ Atlantic Council, *Envisioning 2030: U.S. Strategy for the Coming Technology Revolution* (Washington, DC: Atlantic Council, 2013), i.

⁵² Jason Augustyn, *Science and Technology Trends 2013-2043: A Review of Leading Forecasts* (FutureScout Report No. FS-TR-2013-01) (Washington, DC: U.S. Department of the Army, 2014), 7-8.

⁵³ National Intelligence Council, *Global Trends 2030*, 83.

⁵⁴ Melvin Kranzberg, “Technology and History: Kranzberg’s Laws,” *Technology and Culture* 27, no.3 (1986): 544-560.

- Technology is a very human activity.

Furthermore, Kranzberg's Laws will likely be considered even more prescient in the increasingly globalized, connected, and technology-diffuse future.

Current State

Multiple factors contribute to and describe the current state of technology development. Most significant among them are (1) an unprecedented level of global interconnectedness; (2) the ever-increasing pace of technological change and technology diffusion;⁵⁵ (3) the role, importance, and level of government-funded technology development; (4) the pace of technological and scientific innovation in the private sector; and (5) increased technology innovation associated with economic growth in the developing world.⁵⁶

The trends relating to these five factors, coupled with patterns and trends in specific science and technology (S&T) areas, provide insights on how they might shape and impact broad areas in the next several decades. Forecasts conclude that there will be significant impact to multiple fields including, but not limited to, economics, industry, healthcare, urbanization, agriculture, energy, and military development.

Principal Patterns and Trends

Global Interconnectedness. Global interconnectedness is increasing, and the accelerating rate of new technology absorption by developing countries is one of the most impressive features of the technological revolution and one driver of globalization.⁵⁷ This interconnectedness will empower non-state as well as state actors. This trend has the effect of "leveling the playing field," whereby state and non-state actors, large and small, compete increasingly as equals. A flattened world such as this, due in no small measure to communications and computer technologies, will provide broad access to disruptive technologies previously available only to state actors in the developed world.

Technology Change and Diffusion. While not all experts agree with Ray Kurzweil's "Law of Accelerating Returns,"⁵⁸ the current speed of technological change and technology diffusion is unprecedented. Examples include the doubling of computing power every 24 months, a dramatic decline in the costs of genetic sequencing, dramatic cost reductions in the transmission of data, and a 3-million-fold decrease in data storage costs in the last three decades.⁵⁹ The convergence and synergies of several broad technologies, including but not limited to biotechnology, additive

⁵⁵ U.S. Department of Defense, *Quadrennial Defense Review 2014* (Washington, DC: U.S. Department of Defense, 2014), 6.

⁵⁶ National Intelligence Council, *Global Trends 2030*, 83.

⁵⁷ Atlantic Council, *Envisioning 2030*, 2.

⁵⁸ According to "The Law of Accelerating Returns," the rate of change in a wide variety of evolutionary systems, including the growth of technologies, tends to increase exponentially. Ray Kurzweil, *The Age of Spiritual Machines: When Computers Exceed Human Intelligence* (New York: Viking Penguin, 1999), 29-30.

⁵⁹ Atlantic Council, *Envisioning 2030*, 1.

manufacturing, and new materials and robotics, have the potential to produce unprecedented social, economic, and political disruption.⁶⁰

Private and Public Technology Development and Innovation Funding. Although industry funds the majority of R&D in the United States, the importance of the state as the “one entity that can bear the risks of spending money on R&D when the commercial uses are not yet evident”⁶¹ is worth emphasizing. The myth that many of the biggest technological breakthroughs came from bold entrepreneurs was recently debunked by Mariana Mazzucato, an economics professor at the University of Sussex.⁶² Mazzucato cites many examples:

- The U.S. National Science Foundation (NSF) funded the algorithm that drove Google’s search engine.
- The technologies that make the iPhone “smart” were publically funded—the Internet, wireless networks, the global positioning system, microelectronics, touch screen displays, and the latest, voice-activated “Siri” personal assistant.
- In the U.S., Defense Advanced Research Projects Agency (DARPA), the NSF, and National Institutes of Health (NIH) have been the most important engines of public and private sector innovation for both military and civilian applications in the past five decades.

While the United States remains a leader in expenditure of R&D in absolute terms, the Atlantic Council notes the following trends in private and public funding for technology development and innovation:⁶³

- The share of European Union GDP spent on R&D has steadily fallen and is substantially below that of the United States and Japan.
- Inflation-adjusted U.S. government spending on basic R&D has flat-lined since about 2003 and it will decline sharply as a percentage of GDP if the government fully implements sequestration budgets.
- The NIH’s budget could drop 7.6 percent in the next five years; research programs in energy, agriculture, and defense will decline by similar amounts; and the National Aeronautics and Space Administration (NASA) research budget could drop to its lowest level since 1988.⁶⁴
- In contrast, there has been a dramatic growth in Chinese R&D using both public and private resources, indicative of efforts to become a leader in innovation and position themselves as a potential first mover in the biotechnology and green energy fields. Of note, China’s R&D spending could surpass comparable U.S. spending by the early 2020s.⁶⁵

⁶⁰ Ibid.

⁶¹ Ibid., 23.

⁶² Mariana Mazzucato, *The Entrepreneurial State: Debunking Public vs. Private Sector Myths* (New York: Anthem Press, 2013), iBook edition, 228 of 300.

⁶³ Atlantic Council, *Envisioning 2030*, 23-25.

⁶⁴ Ibid., 24.

⁶⁵ Martin Grueber and Ken Studt, “2014 Global R&D Funding Forecast,” *R&D Magazine*, 9 December 2013, <http://www.rdmag.com/articles/2013/12/2014-r-d-magazine-global-funding-forecast>.

Technology Innovation and Economic Growth. One can reasonably expect technology innovation to expand and accelerate most in regions of the world that experience relatively high economic growth and thereby produce the economic surplus needed for investment. Therefore, the vibrant economic growth that will continue to benefit developing countries (e.g., China, India, and Brazil) for some time will likely also stimulate increased technological innovation in the coming decades.

To gain clarity concerning specific technology areas affected, the Deputy Assistant Secretary of the Army for Research and Technology (DASA R&T) commissioned a report to review recent S&T forecasts produced by leading think tanks and analysis organizations inside and outside of government. Of note, the review aimed to provide an overview of areas of S&T “that promise to have very high impact in both the civilian and military spheres over the coming decades [emphasis added].”⁶⁶ FutureScout, LLC performed the review for DASA R&T. They selected 8 recent forecasts and initially identified 115 specific S&T trends.⁶⁷ Further sorting the 115 trends via bibliometric and semantic analysis,⁶⁸ FutureScout identified 16 common themes (the percentage figures included in parentheses indicate the degree of concurrence across the 8 forecasts analyzed):

- Human 3.0 (human augmentation technologies) (75 percent);
- Robotics and Autonomous Systems (75 percent);
- Additive Manufacturing (63 percent);
- Big Data, Tamed? (big data analytics and data to decision) (63 percent);
- Energy Revolution (63 percent);
- Internet of Things (ubiquitous sensors embedded in interconnected computing devices) (50 percent);
- “Sci-Fi” Medicine (emerging revolutions in medical care) (50 percent);
- Quantum Computing (50 percent);
- Social Grows Up (the future of cloud-enabled social connectivity) (50 percent);
- Synthetic Biology (the creation of new forms of life through engineering of the genetic code) (50 percent);
- Ubiquitous Nanotechnology (nanotechnology widely used to create new, functional materials) (50 percent);
- Resilient Agriculture (technology to feed the world in the face of extreme climate change) (38 percent);
- Sustainable Cities (technology to make cities more energy efficient and livable for ever-growing populations) (38 percent);

⁶⁶ Augustyn, *Science and Technology Trends 2013-2043*, 1.

⁶⁷ Ibid., 2-3 and 5.

⁶⁸ Bibliometric analysis involves the statistical analysis of citations in written publications, such as books or articles, with the aim of determining the popularity and impact of specific articles, authors, and publications. In general, semantic analysis involves a systematic analysis of the language, in this case in literature relating to S&T, to identify the most relevant, prominent, or important patterns and trends, as well as those on which there is some degree of consensus.

- Water Technology (technology to supply fresh water for a growing world population) (38 percent);
- Cyber (25 percent); and,
- Directed Energy (25 percent).

Although unanimity concerning the significance of developing technologies does not exist—and, as indicated above, the collective wisdom judges some developing technologies to be more important than others—researchers and practitioners in the S&T field appear to believe these technology-related trends and phenomena will impact the future, and by extension the future security environment.

Implications

The ever-increasing acceleration of developing technologies will have far-reaching global impact across multiple fields. Recent technology forecasts, studies, and research papers use varying methods and naming conventions to catalogue the possible impacts of developing technologies. Research suggests impacts in five areas: social, political, economic, environmental, and defense. The table below depicts the possible impacts, organized in five focus areas, on which there is the most consensus.

Table 2-1. Implications of Principal Technology Trends⁶⁹

Trend	Social	Political	Economic	Environmental	Defense
Human 3.0⁷⁰ <i>What will it mean to be “human”?</i> <u>Enabling S&T</u> -Brain science -Genetics -Information technology -Biotechnology	The ability to transcend innate limits will be liberating, but raises difficult questions about what it means to be human. Distinct sub-cultures could arise around particular types of enhancement.	Through 2040 augmentation will be costly, leading to a two-tiered world of enhanced “haves” and “have-nots.” This will create political unrest and difficult regulatory issues.	The market for augmentation technology is massive and blurs lines between traditional markets. Entirely new industries will emerge to serve Human 3.0.	Environmental impacts from human augmentation should be limited, though resource conflicts could grow as enhanced humans become more active and longer-lived.	Temporary enhancements (e.g., exoskeletons, nootropics [see note below]) will revolutionize soldier capabilities and reduce training time. Powerful, permanent enhancements will raise ethical issues. We should expect to face adversaries that are just as augmented as we are.
Robotics/ Autonomous Systems <i>How will we coexist with sentient machines?</i> <u>Enabling S&T</u> -Neuroscience & artificial intelligence -Sensors/control systems -Power & energy -Human-robot interaction	Robots/autonomous systems will become part of the social landscape. As autonomy and intelligence grow, these systems will raise difficult questions about the role of personal responsibility and “machine rights.”	As science and society further integrate robots/autonomous systems, political systems will face challenging legal and regulatory issues around how much autonomy to grant robots.	Robotics will transform work, eliminating the need for a wide variety of manual labor. While the gains in efficiency will be a boon for global markets, the loss of manufacturing jobs could cripple developing economies.	Robots/autonomous systems will be able to clean up pollution in areas too hazardous for humans to enter. For example, robot relief crews will be able to mitigate disasters such as the Fukushima nuclear incident.	As robots/autonomous systems become more capable, the U.S. Army will have to reevaluate the soldier’s role in combat. Robots will revolutionize just about every aspect of military operations. Their ubiquity will mean that our adversaries will also use robotic systems, and they might be willing to go further in giving combat robots complete autonomy.

⁶⁹ The table was constructed by the writing team from information and data contained in Augustyn, *Science and Technology Trends 2013-2043*, 12-21.

⁷⁰ Human 3.0 refers to emerging technologies (e.g., nootropic drugs, also referred to as smart drugs, memory enhancers, neuro enhancers, or cognitive enhancers; exoskeletons; embedded sensors and computers, including in contact lenses; and more permanent implants) that will enable transcendence of traditional limits on human potential.

Trend	Social	Political	Economic	Environmental	Defense
<p>Additive Manufacturing (i.e., 3-D printing) <i>What happens when a factory fits on a desktop?</i></p> <p><u>Enabling S&T</u></p> <ul style="list-style-type: none"> -Improving speed, size, & quality -Materials -Bioprinting. i.e., making living tissue with a 3-D printer 	<p>3-D printing, combined with social media technology, could move “maker” culture into the mainstream. People will be able to collaborate, customize, and share design files in ways that will be difficult to predict or control.</p>	<p>3-D printing raises serious questions around protecting intellectual property. Imagine the complexity of policing online piracy of music, movies, and software. Now apply the same difficulties to every physical object.</p>	<p>Additive manufacturing will make it possible to do low-rate production and customization cost-effectively. This could create/increase economic activity to over \$500 billion per year across multiple industries.</p>	<p>Additive manufacturing is extremely efficient and generates far less waste than molding or machining. Point-of-use production will also reduce pollution from transporting goods across countries and continents.</p>	<p>3-D printers could transform military logistics by allowing units to print equipment and spare parts in the field. At the same time, adversaries will be able to print weapons cheaply and from raw materials that are difficult to track and control.</p>
<p>Big Data, Tamed? <i>How will we make sense of chaos?</i></p> <p><u>Enabling S&T</u></p> <ul style="list-style-type: none"> -Visualization -Machine learning -Natural language processing -Data fusion 	<p>Mastering big data will have a profound impact on health care. For instance, epidemiologists will be able to better understand interactions among genetic and environmental factors in cancer, heart disease, diabetes, and other diseases.</p>	<p>As the Snowden affair shows, there are difficult political issues surrounding who should have access to data and for what purpose. As analytic capabilities mature, the information value of data will increase, as will the pitfalls of data access.</p>	<p>Big data analytics will touch most economic sectors by 2040. If current growth trends hold, the combined market impact of big data will exceed half a trillion dollars by 2020.</p>	<p>The ability to gain insights from massive amounts of climate data will revolutionize climate modeling, enabling better predictions of climate change and weather.</p>	<p>Big data analytics will transform the ability to draw actionable intelligence from the sea of sensors on future battlefields. At the same time, as analytic solutions become widely available, adversaries will exploit civilian sensor networks to collect intelligence at little to no cost.</p>
<p>Energy Revolution <i>How will we power the future?</i></p> <p><u>Enabling S&T</u></p> <ul style="list-style-type: none"> -Solar efficiency -Battery technology -Biofuels -Energy harvesting 	<p>As the global middle class rises and contributes to increased consumption, power and energy will become critical issues with the potential to unify or divide civil societies.</p>	<p>Climate change and environmental risks from nontraditional fossil fuel extraction will drive global political debates over the role of oil and natural gas versus expanded use of renewable energy sources.</p>	<p>Domestically, the discovery of massive oil and natural gas reserves will bolster the U.S. economy. Globally, the emergence of renewable fuels will spark new industries that could benefit developing nations.</p>	<p>Reliance on oil and coal will increase atmospheric CO₂, driving additional climate change. Negative effects may be offset by alternative energy technologies that are cost-competitive with fossil fuels.</p>	<p>The prospect of U.S. energy security will significantly reshape the strategic environment. While we become less dependent on foreign sources of energy, traditional oil-producing powers could experience significant economic disruption, opening the door for extremist ideologies to take root.</p>

Three implications are most apparent. First, when examining technology trend forecasts, it is important to look beyond the trend or “device” titles to see which S&T areas are required to enable them. As depicted in the left-hand column of table 2-1, each of the five top focus areas relies on at least three S&T enablers. Trends in each focus area will hold only if all of the indicated S&T enablers reach critical levels of advancement, effectiveness, and/or efficiency.

Second, capabilities inherent in or emerging from the trends will be theoretically available to state and non-state actors, and in some cases to individuals. Still, many of these innovations will require additional technical advances (beyond the S&T enablers depicted) to make them fully effective, and achieving these advances could be out of reach for some less-capable actors. The final products will be composed of many separate elements of different technologies combined in a single device or complex system, and their implementation will involve “many complicated sociocultural factors, especially human elements, even in what might seem to be ‘purely technical’ decisions.”⁷¹

Finally, countries will be challenged to find ways to capture and reap the benefits from new technologies while simultaneously dealing with potential threats posed by those technologies. This, in part, reinforces the importance of U.S. government-funded R&D to ensure not only continued development of future technologies but also the ability to protect the technologies and complex technological systems that are essential to the economy and national defense.

In sum, the accelerating pace of technological discovery fueled by ever-increasing global access to information, education, materials, tools, and manufacturing capabilities shows no signs of slowing.⁷² Leading experts agree that the common S&T trends discussed above will have significant impacts in a broad range of areas (social, political, economic, environmental, and defense). There will certainly be surprises, but if the history of technology reveals anything, it is that the biggest surprises will not come from a single technology. Instead, the greatest changes will come from the cross-symbiotic impact of technologies interacting with each other.⁷³ It is unclear whether these interactions will result in true technological change that affects the future security environment in an evolutionary or revolutionary way.

Competition for Resources

According to the NIC, “The increasing nexus among food, water, and energy—in combination with climate change—will have far-reaching effects on global development.”⁷⁴ Resource competition, accelerated by population growth, urbanization, globalization, and changing consumption patterns,

⁷¹ Kranzberg, “Technology and History,” 551.

⁷² “Envisioning Emerging Technology for 2012 and Beyond (2012),” *Envisioning*, last modified March 2012, www.envisioning.io/2012.

⁷³ Atlantic Council, *Envisioning 2030*, 23.

⁷⁴ National Intelligence Council, *Global Trends 2030*, 31.

is placing increased stress on the availability of sufficient water, food, and energy resources.⁷⁵ In many regions, food and water resources are already under significant stress. As a result, localized resource shortages will intensify human hardship and promote resource competition. As noted by the NIC, “While we are not necessarily headed into a world of scarcities, without substantial outside assistance, some nations will struggle to provide basic needs across their populations.”⁷⁶ These stressors increase the risk of cascading effects on stability, security, health, and economic improvement. In addition, controlling sources of water, food, and/or energy offers greater power and influence to those in control. Manipulation of resources as a political tool or weapon is a growing likelihood up to and including the 2030-2045 timeframe.

Current State

Current trends suggest that resource competition will become one of the more pronounced features of the global security environment and will exacerbate social disruption, humanitarian assistance, and potentially conflict. The connection of water, food, and energy will serve as both an opportunity for international cooperation and a potential driver of instability.

Fresh water is the most important resource for humankind, crosscutting all social, economic, and environmental activities. It is also a dichotomous resource—enabling or limiting social and technological development, serving as a source of welfare or misery, and acting as a catalyst for cooperation or conflict.⁷⁷ Without substantial investment and political commitment, water shortages will likely worsen from the untimely combination of antiquated infrastructure, overuse of aquifers, wasteful irrigation practices, resource extraction, and biofuels production, as well as the effects of population growth, urbanization, pollution, and climate change.

The World Bank estimates that most of the 1.4 billion people who live in extreme poverty also suffer from acute fresh-water shortages. Over 700 million people lack access to clean water and over 2 billion lack suitable sanitation services, with most of these people living in the least developed countries. A staggering 80 percent of people who live in sub-Saharan Africa, Eastern Asia, or Southern Asia suffer from physical and/or economic water scarcity. Many do not have access to an adequate drinking water source. Physical water scarcity refers to inadequate water resources to meet a country’s or region’s demand, including the water needed to fulfill the demand of area ecosystems to function effectively. Economic water scarcity refers to a situation in which the water is available, but there is insufficient infrastructure or technology to draw water from rivers, aquifers, or other water sources and distribute it to points of need. Figure 2-5 illustrates the extent of global physical and economic fresh-water scarcity.⁷⁸

⁷⁵ Ibid.

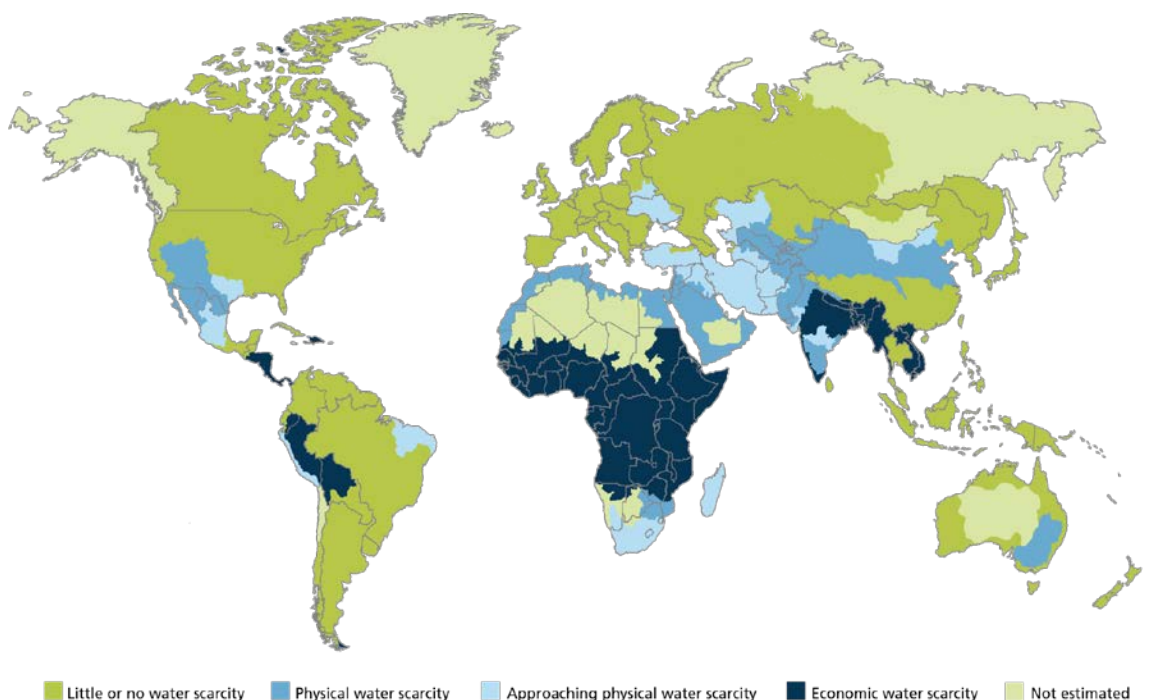
⁷⁶ Ibid.

⁷⁷ “Water,” *United Nations Educational, Scientific, and Cultural Organization*, accessed 19 February 2015, <http://www.unesco.org/new/en/natural-sciences/environment/water>.

⁷⁸ Figure 2-5 is derived from map 2.1 in David Molden et al, “Trends in Water and Agricultural Development,” in David Molden, ed., *Water for Food, Water for Life, A Comprehensive Assessment of Water Management in Agriculture* (Colombo:

(note continued)

Figure 2-5. Global Physical and Economic Fresh-Water Scarcity



Source: David Molden, ed., *Water for Food, Water for Life, A Comprehensive Assessment of Water Management in Agriculture* (Colombo: International Water Management Institute, 2007).

While water resources have not historically resulted in interstate warfare, water issues have created friction between nations and have led to local internal conflicts.⁷⁹ The Pacific Institute reports an increase in water-related military, political, and terrorist actions in recent years, although most of the incidents were localized and lacked broader regional impact. For example, in 2014 Russia accused Ukraine of cutting water supplies in the North Crimean Canal, thereby producing water shortages. The Syrian civil war and the displacement of refugees into Jordan contributed to riots related to water shortages.⁸⁰

International Water Management Institute, 2007), 67. The map in the source document is the result of International Water Management Institute analysis done for the Comprehensive Assessment of Water Management in Agriculture using the Watersim model.

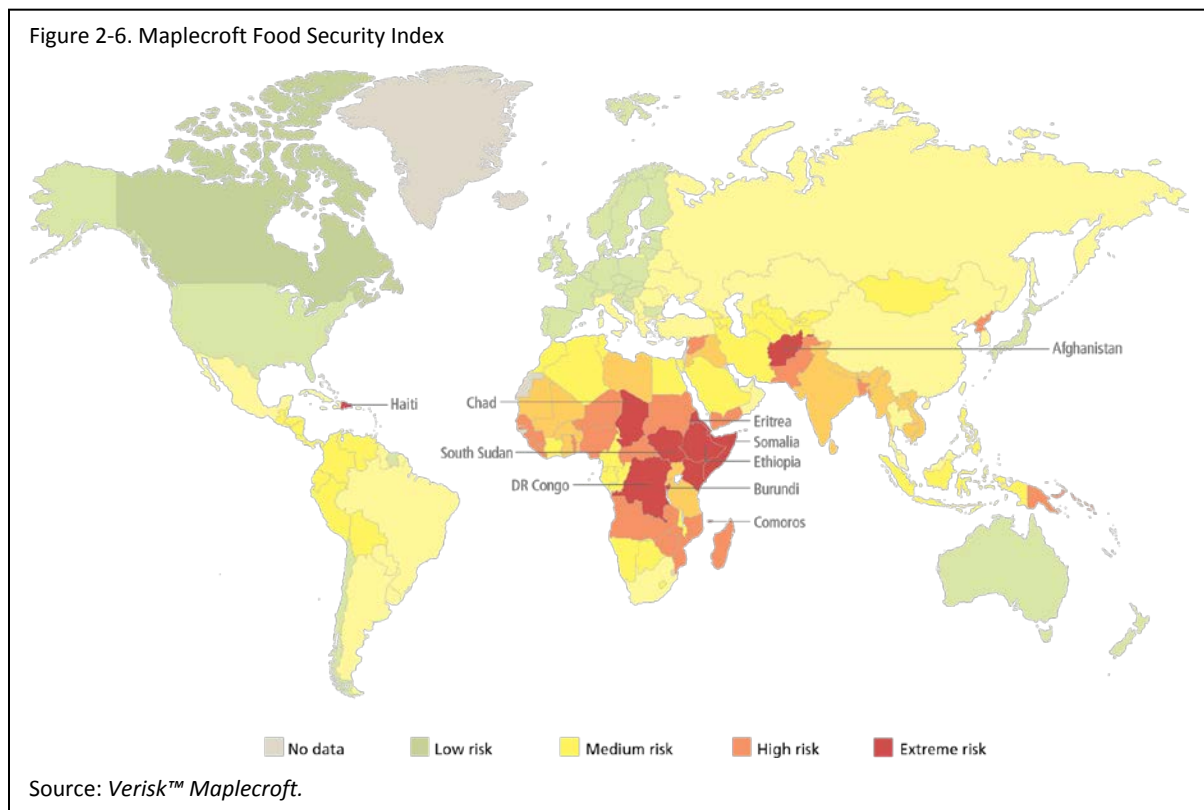
⁷⁹ Stephen Leahy, "Water Crisis Hitting Food, Energy—And Everything Else," *Global Policy Forum*, 22 March 2013, <https://www.globalpolicy.org/the-dark-side-of-natural-resources-st/water-in-conflict/52367-water-crisis-hitting-food-energy--and-everything-else.html?itemid=id#40395>.

⁸⁰ Peter H. Gleick, "Water Conflict Chronology," *Pacific Institute for Studies in Development, Environment, and Security*, last modified 10 November 2008, <http://worldwater.org/conflictchronology.pdf> and "Syria crisis: Deadly clash in Jordan's Zaatari camp," *BBC*, 6 April 2014, <http://www.bbc.com/news/world-middle-east-26908587>.

Food insecurity implies the limited or uncertain availability of nutritionally adequate and safe foods.⁸¹ Technological advances and improved farming techniques have broadly kept pace with population growth and have contributed to a generalized amelioration in global hunger. A 2013 United Nations study reported a 17 percent decline in chronic hunger. Still, estimates indicate 842 million people suffer from chronic hunger. Despite overall progress measured globally, marked differences across regions persist. Figure 2-6 illustrates the global extent of food insecurity.⁸²

Oil and related hydrocarbons dominate the energy environment and energy geopolitics, and they will continue to do so. Recent technological advances in resource extraction, such as hydraulic fracturing (i.e., “fracking”), have increased access to previously unavailable hydrocarbon resources and significantly expanded global supply. Renewable energy such as wind and solar provide additional contributions to the global energy supply and, critically, have the capacity to provide limited energy to even the most remote regions, particularly when coupled with emerging energy storage technologies such as advanced batteries.

Similar to food and water supplies, global energy distribution is very uneven, with limited capacity in impoverished regions. Many governments continue to struggle with the ability to access,



⁸¹ The definition is from S. A. Anderson, ed., “Core Indicators of Nutritional State for Difficult to Sample Populations,” *The Journal of Nutrition* 120 (1990): 1557S–1600S.

⁸² “New Products & Analysis,” Verisk™ Maplecroft, accessed 19 February 2015, http://maplecroft.com/about/news/food_security_risk_index_2013.html.

maintain, and distribute sufficient energy supplies for major segments of their populations. Many nations also suffer from an aging electrical infrastructure that struggles to handle the present energy demand, a situation that will persist in the future.

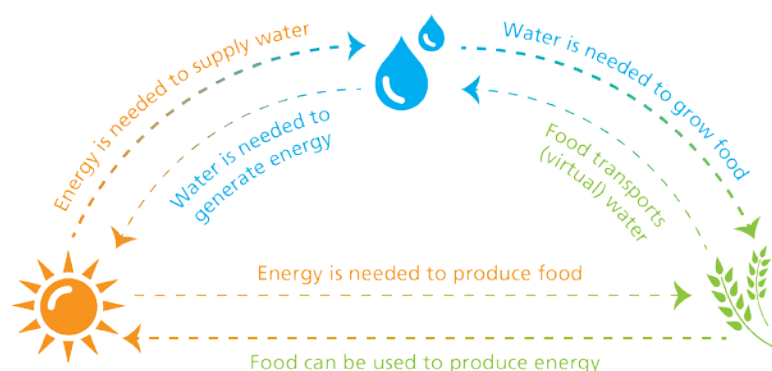
Principal Patterns and Trends

Water, food, and energy are inextricably linked, and events or actions in one area invariably affect one or both of the other two areas. Figure 2-7 depicts this water-food-energy nexus.⁸³ This combination is emerging as a framework for resource management in many regions. Efforts within the developing world generally lag those of more economically viable nations. As noted in *Global*

Trends 2030, “many countries won’t have the wherewithal to avoid food and water shortages without massive help from the outside.”⁸⁴

Water. As noted in a UN report, “food, energy, opportunity for economic growth, human and environmental health, and protection against water-related disasters are all necessary ingredients of development, including income generation and poverty reduction. They all depend on water.”⁸⁵ Absent more effective

Figure 2-7. Water-Food-Energy Nexus



Source: United Nations University, Institute for Water, Environment, and Health, *Water Security & the Global Water Agenda—A UN-Water Analytical Brief* (Hamilton, ON: United Nations University, 2013).

management of water resources, fresh water availability will not keep up with demand. Water problems will hinder capacities to produce food and generate energy, posing a risk to global food markets and hobbling economic growth.⁸⁶ In their analysis “Global Water Security,” the U.S. intelligence community assesses that water problems, when combined with poverty, social tensions, environmental degradation, ineffectual leadership, and weak institutions, will contribute to social disruptions that threaten local security, amplify other social and governing stressors, and lead to the erosion of state legitimacy and authority. In addition, water sources will likely be used as leverage against neighboring downstream countries. Similarly, states will use water internally to pressure

⁸³ United Nations University, Institute for Water, Environment, and Health, *Water Security & the Global Water Agenda—A UN-Water Analytical Brief* (Hamilton, ON: United Nations University, 2013), 14.

⁸⁴ National Intelligence Council, *Global Trends 2030*, iv.

⁸⁵ United Nations, *Managing Water under Uncertainty and Risk—The United Nations World Water Development Report 4, Volume 1* (Paris: United Nations Educational, Scientific, and Cultural Organization, 2012), 127.

⁸⁶ Director of National Intelligence, *Global Water Security* (ICA 2012-08) (Washington, DC: Director of National Intelligence, 2012), iii.

populations and suppress separatist elements, and terrorist acts against water infrastructure are likely to become more attractive.⁸⁷

Agriculture will continue consuming the vast majority of available freshwater supply.⁸⁸ Combined with explosive population growth and the emergence of a larger, wealthier middle class, increasing demand for food, energy, and consumer goods will place further stress on water supplies.

Pollution is an increasing trend, especially in developing countries. Rapid urbanization—and the byproduct slums—will pollute many potable water sources. Lack of plumbing, poor sanitation, inadequate waste removal, inadequate water infrastructure, and poor water management will all contribute to urban fresh water challenges.⁸⁹ Additionally, changes in weather patterns suggest increased water stress in many regions. Diminishing renewable water resources are creating an overreliance on limited underground aquifers, further intensifying future water shortfalls and scarcity.

While a broader awareness for improved water management is gaining recognition, solutions are expensive and time-consuming, and they typically occupy lower priorities across municipal budgets. Meaningful improvement will elude many regions, likely contributing toward increased tensions.

Food. Analysts expect global food demand to rise 35 percent by the beginning of the forecast period. While some studies voice cautious optimism regarding a broader ability to maintain global food production, most assessments paint a more dire challenge.⁹⁰ Rising prices of key staples (such as wheat and rice), inconsistent food distribution, population growth, and changing weather patterns create substantial risk. The majority of countries experiencing rapid population growth are precisely those countries suffering from inadequate food production and high levels of undernourishment. Food shortages will continue to plague poor nations hampered by security challenges, corruption, and lack of technology. Most of them are in sub-Saharan Africa and Southern Asia.⁹¹

⁸⁷ For example, Egypt voiced concerns and threatened military action against Ethiopia if the Grand Ethiopian Dam ultimately restricts the Nile River. Moreover, in 2014 Islamic State insurgents seized the Fallujah Dam in Iraq, closing the floodgates. The objective was to flood the area around Fallujah to force government troops to retreat and lift a siege, while cutting water supplies and hydroelectricity for other parts of the country. Eventually, the insurgents re-opened five of the dam's gates, fearing their strategy would flood their own Fallujah stronghold. Flooding around the city resulted in civilian evacuations and forced government troops to alter their operations in the area. See, for example, "Iraq insurgents use water as weapon after seizing dam," *Reuters*, 11 April 2014, <http://www.reuters.com/article/2014/04/11/us-iraq-security-idUSBREA3A0Q020140411>.

⁸⁸ Director of National Intelligence, *Global Water Security*, 3.

⁸⁹ For a concise, but thorough, assessment of the fresh water challenges associated with pollution, see United Nations, Department of Economic and Social Affairs, Population Division, *World Urbanization Prospects: The 2014 Revision, Highlights* (New York: United Nations, 2014).

⁹⁰ "2050: A Third More Mouths to Feed," *Food and Agriculture Organization of the United Nations*, 23 September 2009, <http://www.fao.org/news/story/en/item/35571/icode>.

⁹¹ Nikos Alexandratos and Jelle Bruinsma, *World Agriculture Towards 2030/2050: The 2012 Revision* (ESA Working Paper No. 12-03) (Rome: United Nations, 2012), 29-40.

As globalization economically lifts more of the world's population, a growing middle class that is more educated and affluent is demanding a more diverse and nutritious diet. This change in dietary habits is contributing to increased meat consumption, replacing traditional diets based on rice, maize, or soybeans. This shift is significantly increasing the strain on farmland required for animal grazing while simultaneously reducing the amount of farmland available for crop production. This trend could lead to local food imbalances that will affect migration patterns and exacerbate existing social unrest.

Additionally, many nations that rely on food imports to meet their rapidly growing domestic demands are bypassing world food markets and are purchasing land overseas.⁹² A September 2011 Oxfam⁹³ study contends that farmland equal to an area the size of Western Europe has been sold or leased to foreign investors since 2001. This strategy enables food-importing nations to secure food supplies that are sent home for consumption or, as likely, may be used for biofuel production. Expansion of bioenergy farming may help improve energy supply, but it also results in increased competition for land and water resources with negative impacts on food production.⁹⁴

Technology advancements have notably created most agricultural gains over the past few decades. Future technology may further advance food productivity. Genetically modified seeds may expand the yield per acre, allow crops to grow with brackish water, and offer harvests that thrive in poorer soils. Until then, the broader trend suggests that food security will elude poorer, less capable regions. A growing shortage of water and energy necessary to plant, harvest, and distribute sufficient food supplies further aggravates food security.

Energy. By 2040, analysts expect energy demand to increase by 50 percent, challenging global energy production and distribution capabilities. Southern and Eastern Asia will account for the largest increase in energy consumption with significant population growth and a corresponding expansion of a more affluent middle class that demands more and higher quality food, water, and consumer goods. Unmet energy demands from poorer and rural regions will create dissatisfaction among many, further pressuring local governments and stressing an increasingly fragile energy infrastructure.

The global economy will continue its reliance on oil and other hydrocarbons, to include continued use of farmland to grow biofuel crops.⁹⁵ Oil-related geopolitics will dominate economic policies and drive global acquisition and economic development. Technological advances are producing significant access to previously unavailable energy resources. Fracking is opening shale oil

⁹² Michael Kugelman and Susan Levenstein, eds., *The Global Farms Race: Land Grabs, Agricultural Investment and the Scramble for Food Security* (Washington, DC: Island Press, 2013), Kindle edition, location 105 of 4778.

⁹³ Oxfam is an international confederation of 17 organizations working together with partners and local communities in more than 90 countries. Around the globe, Oxfam works to find practical, innovative ways for people to lift themselves out of poverty and thrive.

⁹⁴ Kugelman and Levenstein, eds., *The Global Farms Race*, location 105 of 4778.

⁹⁵ Ibid.

and natural gas fields. Brazil is successfully advancing ultra-deep-water drilling techniques. Other countries characterized as “oil economies”—those that rely on oil revenues to maintain large social entitlement and subsidy programs, such as Venezuela, Nigeria, and Algeria—will be buffeted by changes in supply, demand, and prices. If oil-funded social programs deteriorate, the potential for unrest grows more prevalent, particularly when combined with other destabilizing internal factors such as corruption, inflation, overcrowding, and poor governance.

In poorer regions, energy impacts are perhaps even more significant. The water-food-energy combination is more foundational to basic needs and survival. For example, the International Food Policy Research Institute emphasizes, “it is small scale farmers who feed the majority of the world, producing food for about 70 percent of the population.”⁹⁶ An imbalance of energy and water threatens food productivity. As a result, the opportunity to elevate millions of people out of hunger, poverty, and disease may remain elusive, and shortcomings in these areas will pose a significant threat to stability.

Implications

Current trends suggest an increasing likelihood that water, food, and energy will be factors affecting—and likely drivers of—future instability and crises. They will be a potential means of coercion, and some belligerents will be in a position to employ them as “weapons” in actual conflict. Similar to weather and terrain, military planners should continue to anticipate that regional engagement and operations will be influenced by local politics, distribution challenges, and shortfalls centering on—or peripherally involving—water, food, and energy.

Critical shortages in any one of these commodities will require humanitarian activities across the range of military operations, either as the primary mission or certainly as an implied mission. In many cases, military assistance with local food and water shortages will be an obvious necessity to facilitate larger operational tasks and interaction with local leaders.

Pollution and unclean water sources will increase the threat of disease to U.S. forces, particularly in overcrowded urban environments where human waste, garbage, and insects combine with a lack of sanitation. Inadequate infrastructure will further hamper efforts to assist the population and will exacerbate environmental threats to U.S. personnel. U.S. forces will need to be more self-reliant, and force health protection may demand increased emphasis and resources.

From a social perspective, wealthier populations will be able to obtain alternative water, food, and energy sources. Conversely, the inability of the poorer masses—the “have-nots”—to access adequate supplies may be a source of resentment and tension. Income inequality, when combined with resource shortfalls, may further exacerbate a deteriorating security situation and will

⁹⁶ “The Centrality of Land, Water, and Energy for Smallholders,” *International Food Policy Research Institute*, accessed 19 February 2015, www.IFPRI.org/ghi/2012/centrality-land-water-energy-smallholders.

challenge local governments, police, and security forces should widespread riots and demonstrations occur. Disaffected populations will be susceptible to manipulation by local powerbrokers and non-state actors, amplifying the threat to social order and local security. In this environment, U.S. forces are at risk of being targeted by elements seeking to control resources and gain local power.

Coordination with humanitarian aid groups, particularly the U.S. Agency for International Development, offers opportunities to highlight U.S. humanitarian assistance as a demonstration of genuine goodwill and a desire to work closely with local populations, coalition partners, and aid organizations. Likewise, the relationship among water, food, and energy offers opportunities for military commanders to engage in whole-of-government coordination as they prepare for and execute regional engagement strategies.

Stress on the Environment

Environmental stress manifests itself in numerous ways, and several of these observed stresses hold implications for future military engagement and operations. The planet is warming, and this trend will continue throughout the timeframe of this forecast. Along with a general warming of the atmosphere, ocean temperatures and sea levels are rising, glaciers are melting, and the Arctic ice cap is receding. Additionally there is an increase in the intensity—and potentially the frequency—of extreme weather events that cause significant flooding and the erosion of coastal environs.⁹⁷

Within the field of climate study there is broad agreement that climate change, to include the general warming of the earth's surface, will continue throughout the current century. While natural forces have clearly influenced the earth's climate over time, there is evidence suggesting that increases in global temperature over the last 50 years are also related to or can be attributed to human activity.⁹⁸ Although the degree to which natural cycles versus human activity cause rising surface temperatures may be unsettled, current data suggest that the atmosphere will continue to warm throughout the 21st century. By 2040, average global temperature is likely to have increased 3.6 degrees Fahrenheit over pre-industrial levels.⁹⁹

The debates over the causes of climate change notwithstanding, there are a number of observed linkages between the warming of the earth's surface and other environmental phenomena. As surface temperatures rise in more arid climates, the water content of the soil

⁹⁷ U.S. Department of Commerce, National Oceanic and Atmospheric Administration, "New analyses find evidence of human-caused climate change in half of the 12 extreme weather and climate events analyzed from 2012," NOAA, 5 September 2013, <http://www.noaanews.noaa.gov/stories2013/20130905-extremeweatherandclimateevents.html>.

⁹⁸ Intergovernmental Panel on Climate Change, "Summary for Policymakers," in *Climate Change 2007: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, eds. M.L. Parry et al (Cambridge: Cambridge University Press, 2007), 7-22.

⁹⁹ U.K. Ministry of Defence, Development, Concepts, and Doctrine Centre, *Global Strategic Trends—Out to 2040, Fourth Edition* (Shrivenham, UK: Ministry of Defence, 2010), 21.

decreases, thereby contributing to regional desertification. Warming of the oceans causes a corresponding rise in average sea levels over time and has resulted in the observed melting of the Arctic ice cap and a net reduction in arctic mass. Additionally, there are established connections between warming of the land mass and seas and an increase in the frequency and severity of extreme weather events.

Current State

A continually growing field of climate study has produced a credible international consensus that the planet is warming and that over time this trend will have more harmful than beneficial effects on the environment. The earth's average temperature is the warmest it has been for over 400 years, and within the last century alone it has increased by 2 degrees Fahrenheit.¹⁰⁰ According to the National Climate Assessment, the U.S. average temperature has increased from between 1.3 degrees Fahrenheit to nearly 2 degrees Fahrenheit since the end of the 19th century with most of the increase occurring after 1970.¹⁰¹ There are dissenting views, but most scientists and interest groups around the world believe that the planet's warming is largely due to man's burning of fossil fuels, the clearing of forests, certain agricultural practices, and the consequent production of greenhouse gasses.¹⁰²

As global average surface temperatures have risen over time, average annual ocean temperatures have also increased and there has been a consequent rise in sea levels. While the oceans have warmed at a lesser rate than the atmosphere, perhaps 0.18 degrees Fahrenheit over the last century, the impact is noteworthy. Thermal expansion of warming oceans and melting of land-based (glacial) ice, as well as sea ice, due to surface warming are the major contributors to recorded rises in sea levels. Since 1900, average sea levels have risen at a rate of 0.04 to 0.1 inches annually. This rate may be increasing as indicated by new methods of measurement that show a rise of 0.12 inches per year since 1992.¹⁰³

The navigable area of the Arctic Ocean is getting larger, which is leading to growing international interest in expanded opportunities for mineral extraction, fishing, tourism, and research in the Arctic.¹⁰⁴ Since the 1980s, the amount of open water north of Alaska during the summer months has expanded from 50 kilometers to more than 300. The ice-free season north of

¹⁰⁰ Richard A. Muller, *Physics for Presidents: The Science Behind the Headlines* (New York: W. W. Norton, 2008), 247.

¹⁰¹ Jerry M. Melillo, Terese Richmond, and Gary W. Yohe, *Highlights of Climate Change Impacts in the United States: The Third National Climate Assessment* (Washington, DC: Government Printing Office, 2014), 5.

¹⁰² Intergovernmental Panel on Climate Change, "Summary for Policymakers," in *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, eds. S. Solomon et al (Cambridge: Cambridge University Press, 2007), 2-5.

¹⁰³ U.S. Department of Commerce, National Oceanic and Atmospheric Administration, "Is sea level rising?" *National Ocean Service*, last modified 10 April 2014, <http://oceanservice.noaa.gov/facts/sealevel.html>.

¹⁰⁴ Elizabeth Rosenberg, Dr. David Titley, and Alexander Wiker, *Arctic 2015 and Beyond: A Strategy for U.S. Leadership in the High North* (Washington, DC: Center for a New American Security, 2014), 2.

the Bering Strait now lasts two to three months, and projections indicate this will increase to about five to six months over the next few decades.¹⁰⁵

Warmer air increases the capacity of the atmosphere to absorb and retain water, which likely contributes to observed increases in the intensity of extreme weather events. Climate observers have recorded changes in extreme weather and climate events since about 1950. Between 1981 and 2007, average wind speeds of powerful hurricanes have increased from 225 kilometers per hour to 253 kilometers per hour. The increase in intensity, as well as observed increases in associated precipitation, is attributable to a combination of warmer sea temperatures and warmer air masses that can hold more water.¹⁰⁶ Additionally, atmospheric absorption of more surface moisture results in drier ground conditions. The increase in moisture stored in the atmosphere then leads to more severe precipitation events.¹⁰⁷

Another environmental stress at least partially attributable to climate change is desertification, the degradation of dry land ecosystems in arid, semi-arid, and dry sub-humid areas that results from the combined effects of harsh climates and human activities. Detrimental human activities include unsustainable farming, mining, clear-cutting of forests, and overgrazing. Harsh climate conditions include warmer temperatures, which dry out the land, and periods of drought or reduced rainfall. According to the United Nations Convention to Combat Desertification (UNCCD) almost 30 million acres of arable land are lost to drought and desertification annually.¹⁰⁸ While efforts to slow the rate of desertification or even reverse the trend may show some local results over time, reversal within the next 20 to 30 years is unlikely.

Principal Patterns and Trends

Analysis yields several conclusions relating to the future effects of climate change. Climate change will affect the land, the atmosphere, and the oceans. Sea levels will continue to rise because of the melting of the Arctic cap and temperature-induced water expansion.¹⁰⁹ Rising temperatures will lead to greater desertification, regional food and water shortages, and migration by distressed populations. The oceans will absorb carbon by-product at a steady or accelerating rate, which will increase acidity and negatively impact the food chain.

¹⁰⁵ U.S. Department of Commerce, National Oceanic and Atmospheric Administration, *NOAA's Arctic Action Plan: Supporting the National Strategy for the Arctic Region* (Washington, DC: U.S. Department of Commerce, 2014), 2.

¹⁰⁶ Intergovernmental Panel on Climate Change, "Summary for Policymakers," in *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, eds. T.F. Stocker et al (Cambridge: Cambridge University Press, 2013), 7. Additionally, see Willie Drye, "Strong Hurricanes Getting Stronger; Warming Is Blamed," *National Geographic News*, 4 September 2008, <http://news.nationalgeographic.com/news/2008/09/080904-warming-hurricanes.html>.

¹⁰⁷ David M. Catarious, Jr. et al, *National Security and the Threat of Climate Change* (Alexandria, VA: The CNA Corporation, 2007), 57.

¹⁰⁸ "World Day to Combat Desertification," *United Nations*, accessed 11 March 2015, <http://www.un.org/en/events/desertificationday/>.

¹⁰⁹ Intergovernmental Panel on Climate Change, *Climate Change 2007: The Physical Science Basis*, 57.

Environment and Energy. Global energy usage has approximately doubled over the last half century and is likely to grow by another 50 percent by 2040.¹¹⁰ Attempts to rein in the rate of warming through emissions agreements and alternative energy use will likely only limit the magnitude of change. Responses to the phenomenon of climate change have been and will continue to be a mixture of the symbolic and the meaningful. The 2015 *National Security Strategy* identifies climate change as one of eight top strategic risks to the national interest. Consequently, the Department of Defense should expect to serve as a vehicle to improve the Nation's overall energy efficiency, and authorities will demand that the Department reduce its carbon footprint. Federal government initiatives will—by example and contractual mandate—pressure the commercial sector to adopt higher efficiency and clean air standards.¹¹¹ In fact, a number of traditional defense industrial contractors are investing in green technologies.¹¹²

Environment and the Economy. The developed world is best positioned to reverse its contributions to climate change. However, there is considerable concern that measures to reduce carbon footprints will damage economies. At the same time, as more prosperous nations reduce their discharge of carbon into the atmosphere, other nations that are attempting to grow their economies will get a “free ride,” relying on cheap, high-carbon energy sources to literally fuel their economies and thereby gain a competitive edge. China and India will have little incentive to change their ways and will continue to use carbon-based fuels until their economies more closely match those of fully developed nations. Less-developed nations on the rise, in their turn, will likely employ the same strategic methodology to expand their economies.¹¹³

Diverse and Wide-Ranging Climate Change Effects. While some regions will derive benefits from a warming environment such as longer growing seasons and corresponding increases in crop yields, other locations will suffer from increased desertification. It is likely that locations already under stress will suffer even greater hardship, while countries in more temperate climates may derive benefit from the planet's warming. Climate change will most adversely affect less-developed nations with poorer populations, which are least able to cope with the environmental challenges. While international migration is expected to stabilize, domestic migrations are likely to increase as the less well-off move toward the urban littorals. Influxes of people of different religions, ethnicities, tribes, and family and belief systems will create new tensions. This will increase the burden on welfare infrastructure in places already struggling to cope with societal issues.

The Arctic is likely to melt at an accelerating rate. Between 1953 and 2014, the average area of arctic sea ice shrank 48,000 square kilometers per year. Between 1979 and 2014, it shrank by

¹¹⁰ International Energy Agency, *World Energy Outlook 2008* (Paris: International Energy Agency, 2008), 77-84.

¹¹¹ Jeremiah D. Canty, “Patterns and Trends Report: Climate Change” (report, Potomac Institute for Policy Studies, 2014), 5.

¹¹² Christian Davenport and Amrita Jayakumar, “From fighter jets to fish farms: Why Lockheed Martin is taking on climate change,” *The Washington Post*, 20 March 2015, <http://www.washingtonpost.com/news/business/wp/2015/03/20/from-fighter-jets-to-fish-farms-why-lockheed-martin-is-taking-on-climate-change/>.

¹¹³ Canty, “Climate Change,” 5.

87,000 square kilometers per year and between 1996 and 2014 the rate increased to 148,000 square kilometers annually. While sea ice reflects sunlight, the darker ocean absorbs it.¹¹⁴ As water replaces arctic ice, more sunlight is absorbed and more heat is retained, thus contributing to the increased melting rate. The loss of sea ice will open more of the Arctic Ocean to navigation for longer periods. It is possible that by 2040 the Arctic Ocean will be nearly ice-free during the summer months,¹¹⁵ which will spark increased international interest and maritime activity in the northern reaches.

As navigable routes become persistent, more ships will transit the Arctic, and the U.S. will undertake major efforts to ensure its rights in the region are preserved. Arctic neighbors to include Russia, Canada, and Norway will lay their claims. Together, these Arctic nations will have to confront major players on the global stage who will increasingly believe that even though they do not have valid territorial claims on the region they do have moral and ethical rights. Countries as diverse as Denmark, the United Kingdom, Germany, France, China, and others will consequently feel entitled to play a hand in the Arctic.¹¹⁶

Desertification is likely to continue and possibly accelerate, especially in Africa and parts of South America. While techniques already exist to mitigate this threat and new techniques are likely to emerge, their cost will likely be greater than the monetary return achievable in the short term. Therefore, it will be difficult to introduce new techniques at the local level without outside funding. At best, transnational initiatives may be able to arrest the rate of desertification, but reversing the trend is unlikely in the next several decades.

Implications

Climate-related stresses on the environment have clear implications for the future security environment. The loss of arable land through desertification and warming in general will generate local food shortages and push migration patterns into larger urban areas. Concurrently, warming of the temperate zones may expose humans in these areas to disease-carrying insects that now largely occupy equatorial regions.

Rising sea levels affect the physical structure of coastal regions and expose them to greater risks from storms and flooding. The combination of rising sea levels, large populations occupying the urban littorals, and more frequent and extreme weather events will conjure a nearly perfect storm of natural disasters. Providing relief and humanitarian assistance will become an increasingly complex and resource-intensive endeavor, often complicated by widespread criminal activities. In the less-developed regions of the world, pre-existing struggles for political primacy will further

¹¹⁴ "The Arctic Ocean Awakening," *The Economist*, 14 February 2015, 69.

¹¹⁵ U.S. Department of Commerce, *NOAA's Arctic Action Plan*, 2-3.

¹¹⁶ Canty, "Climate Change," 6.

exacerbate efforts to maintain order, especially where rival paramilitary organizations play a prominent role.

As the number of ice-free months in the northern reaches increases, the Arctic Ocean will become an integral and newly important part of the global commons. There will be a significant increase in maritime traffic, which may catalyze exploration by nations without current, credible Arctic claims. Those with existing territorial and resource claims, primarily Canada, Denmark, Norway, Russia, and the United States, will seek to protect their claims and compete to extract resources. With increased interest, maritime activity, and competing claims by multiple nations, the contentious issues over the Arctic may become as prominent as similar issues that are currently sources of dispute in the South China Sea.

There is no strong evidence yet that these observed stresses on the environment, as they trend into the middle of the 21st century, will be root causes of conflict. However, they will affect regional food and health conditions, and alter migration patterns. Changing weather patterns are likely to result in more frequent and more severe national disasters, and they will add to the difficulties and complexities of relief activities and crisis response operations.

Globalization

Globalization is increasingly connecting governments, people, and products causing interaction and integration at levels never before seen. Largely a result of advances in transportation capability and telecommunications technology, globalization involves the growing international interconnectedness, interaction, and integration of societies, cultures, and economies, including labor, capital, and intellectual capital markets. In the economic sphere, globalization is characterized by increasing trade, competition, migration, and the transfer of monetary funds. All economic classes are affected. While the economic dimension is critical, globalization impacts more than economies. It also affects cultures, groups, and individuals. Globalization increases the complexity of issues confronting the world, and the availability of information through technology is a principal factor increasing globalization. With globalization, vast amounts of information are widely available across political, social, and cultural boundaries, often disrupting markets for goods, services, and ideas; social structures and relationships; and cultural norms and traditions. Those who are able to adapt to the complexity of globalization, with its seeming overabundance of information, gain an exploitable advantage that they can use for either positive or negative purposes. Globalization and its many associated trends are therefore helping to shape the future security environment.

There is no agreed framework for studying globalization, although, according to the University of Pennsylvania's *2014 Global Go To Think Tanks Report*, it is the number one topic discussed by think tanks around the world.¹¹⁷ Most discussions of globalization, however, address

¹¹⁷ James G. McGann, *2014 Global Go To Think Tank Index Report* (Philadelphia, PA: University of Pennsylvania, 2015), 7.

some combination of the economic, political, social, cultural, and technological dimensions that affect globalization.¹¹⁸

Current State

Economists believe the global economy is emerging slowly from the 2007-2008 financial crisis. While developing economies provided economic support during the crisis by helping to offset declining demand in the developed world, thus mitigating the impact of the global downturn, developed economies appear to be providing leadership in the recovery. The International Monetary Fund (IMF) notes, “Global activity strengthened during the second half of 2013 and is expected to improve further in 2014–15. The impulse has come mainly from [developed] economies, although their recoveries remain uneven.”¹¹⁹ The World Bank shares this view.¹²⁰ By multiple 2013 estimates of GDP, a traditional proxy for economic power on the world stage, the United States is the world’s largest national economy followed by China, Japan, Germany, France, United Kingdom, Brazil, Italy, Russia, and India.¹²¹

GDP per capita¹²² is another typical measure of economic strength. According to IMF data, several smaller, wealthier countries such as Luxembourg, Switzerland, and Singapore dominate the top 10; however, their economies and populations are not large enough to translate their wealth into significant national power. Among the countries discussed above that top the rankings by GDP, the U.S. also leads in GDP per capita, ranked 8th, followed by Germany (18th), France (20th), Japan (24th), Russia (50th), Brazil (61st), China (83rd), and India (140th).¹²³

World trade in goods and services is an indicator of the current state and degree of integration or interdependence of the global economy. Despite cyclical fluctuations, world trade has a long history of growth. As transportation and communication costs declined and barriers to trade

¹¹⁸ After examining the organizing approaches taken by reputable institutions, such as the IMF, and prominent experts, including Anthony Giddens, Thomas Friedman, and David Held, in their discussions of globalization, this effort opted to frame discussion of the topic focusing on four aspects of globalization that appear to most impact the future security environment: economic convergence, power diffusion, individual empowerment, and complexity.

¹¹⁹ International Monetary Fund, *World Economic Outlook, April 2014—Recovery Strengthens, Remains Uneven* (Washington, DC: International Monetary Fund, 2014), 1.

¹²⁰ World Bank, *Global Economic Prospects, Volume 8, January 2014* (Washington, DC: World Bank, 2014), 15.

¹²¹ “National Accounts Main Aggregates Database,” *United Nations*, accessed 13 May 2015, <http://unstats.un.org/unsd/snaama/introduction.asp> and “GDP Ranking,” *The World Bank*, accessed 13 May 2015, <http://data.worldbank.org/data-catalog/GDP-ranking-table>.

¹²² Both GDP per capita at “market exchange rates” (MER) and GDP per capita at “purchasing power parity” (PPP) have their strengths and weaknesses. Nominal GDP per capita (MER) is the value of all final goods and services produced within a nation in a given year, converted at market exchange rates to current U.S. dollars, divided by the average (or mid-year) population for the same year. Comparisons of national wealth are also frequently made on the basis of PPP, in an attempt to adjust for differences in the cost of living in different countries. However, PPP has drawbacks. For example, it does not reflect the value of economic output in international trade, and it requires more estimation than nominal GDP per capita. See Tim Callen, “PPP Versus the Market: Which Weight Matters?” *International Monetary Fund*, accessed 11 May 2015, <http://www.imf.org/external/pubs/ft/fandd/2007/03/basics.htm>.

¹²³ “World Economic Outlook Database, April 2014,” *International Monetary Fund*, accessed 10 June 2014, <http://www.imf.org/external/pubs/ft/weo/2014/01/weodata/index.aspx>.

fell, world exports as a share of world GDP grew over the last century from approximately 8 percent (1913) to 11 percent (1973) to 17 percent (1998).¹²⁴ In 2012, world exports of merchandise and commercial services totaled almost 32 percent of world GDP in current dollars.¹²⁵ Additionally, the current data reflect wider geographical participation in international trade, increased trade among developing economies, and greater reliance on international supply chains. Together, these phenomena represent the international economic components of globalization.

Like economic convergence and integration, technology is a prime driver affecting globalization. In years past, enhancements in transportation and communications fueled global economic growth. More recently, the digital revolution has allowed individuals, organizations, and governments to be more connected than ever. The Internet, social media, streaming television, and wireless and satellite communications are challenging traditional notions of cultural and geographic boundaries. People can now transfer pictures, files, and money over the Internet, store and share information in the “cloud,” and participate in virtual meetings around the world. Wireless communications have reduced the requirements for many developing countries to build costly communications infrastructure. In Africa, 65 percent of the population has access to cell phones or smart phones and the Internet.¹²⁶ Global media companies shape the perceptions of people wherever they live. Today, a more decentralized and perhaps “democratized” social media influences a global audience, and organizations incorporate social media into the conduct of daily business.

The expanding global economy, coupled with the widespread use of new communications and manufacturing technologies, leads to greater individual empowerment. Globalization provides individuals and small groups with unprecedented access to ideas, knowledge, and tools. It enables individuals or small groups to coordinate and collaborate with others—even across traditional political, social, and cultural boundaries—who share similar objectives to achieve common goals. Although globalization has been around for centuries, the impact on individuals is accelerating exponentially and will likely continue into the future. Currently, as suggested in the World Economic Forum’s *Outlook on the Global Agenda* reports of 2014 and 2015, there is a leadership crisis in solving globalized problems. The World Economic Forum reports that leaders have not been able to solve many of today’s global issues like climate change, the widening economic gap, or violence by small independent groups.¹²⁷ This leadership deficit presents a significant challenge for economic, political, social, and cultural organizations attempting to adapt and even thrive in the context of globalization.

¹²⁴ World Trade Organization, *World Trade Report 2013—Factors Shaping the Future of World Trade* (Geneva: World Trade Organization, 2013), 47.

¹²⁵ *Ibid.*, 21.

¹²⁶ National Intelligence Council, *Global Trends 2030*, 12.

¹²⁷ World Economic Forum, *Outlook on the Global Agenda 2014* (Geneva: World Economic Forum, 2013), 14-16; and World Economic Forum, *Outlook on the Global Agenda 2015* (Geneva: World Economic Forum, 2014), 22-23.

Principal Patterns and Trends

Economic Convergence and Integration. World economic power is fluid and an integral component of globalization as it relates to the future security environment. Changes in economic power tend to vary, with little consistency, but there are a few major trends that could impact the future. Gaps in per capita GDP that exist today among nations will probably narrow, reducing the overall relative economic power of the G7 nations. This ongoing diffusion of power leads to a more multipolar world.¹²⁸ Economic power is also shifting from the West to the East and the South, and based on well-anchored trends, the productive capacity of E7 nations is expected to surpass that of G7 nations before or during the forecast period.¹²⁹

The World Economic Forum in 2013, 2014, and 2015, along with *Global Trends 2030*, reported that there will continue to be a widening income gap between the poor and the rich. This does not mean the poor are getting poorer. What is undisputed, though, is that the gap between poor and rich will continue to widen. This gap will be even greater in Asia.¹³⁰ Marginally qualified and unqualified workers will make little personal economic progress, while the rich are able to exploit globalization for their economic growth.

The middle class is growing worldwide. Analysts are classifying more people as middle class, both in bulk numbers and in percentage of the overall population. Economic advances in many developing countries are critical factors in people climbing into middle class. The ability of a developing nation to import technology without investing in research or development continues to grow. Additionally, remittances from diaspora populations, which are the single largest income source of developing nations, are on the rise, contributing to increased family incomes for the near future.¹³¹

Diffusion of Power. With continued increasing trade, multinational economic organizations will gain in economic influence relative to national governments. Predominately this will occur where less developed economies are expected to make gains.¹³² Political and social international organizations will also gain influence relative to national governments. *The Joint Operating*

¹²⁸ World Bank, *Global Development Horizons 2011—Multipolarity: The New Global Economy* (Washington, DC: World Bank, 2011), xi.

¹²⁹ The G7 is a group of seven industrialized nations of the world: Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States. The E7 is a group of seven nations with emerging economies: Brazil, China, India, Indonesia, Mexico, Russia, and Turkey. For a good discussion of the developing shift in economic power between E7 and G7 nations, see World Trade Organization, *World Trade Report 2013*, 89-103 and John Hawksworth and Danny Chan, *World in 2050—The BRICs and Beyond: Prospects, Challenges, and Opportunities* (London: PricewaterhouseCoopers, 2013), 6-7.

¹³⁰ World Economic Forum, *Outlook on the Global Agenda 2013* (Geneva: World Economic Forum, 2012), 7-8; World Economic Forum, *Outlook on the Global Agenda 2014*, 12-13; and World Economic Forum, *Outlook on the Global Agenda 2015*, 8-10.

¹³¹ U.S. Joint Forces Command, Joint Futures Group, *The JOE 2010—Joint Operating Environment* (Suffolk, VA: U.S. Joint Forces Command, 2010), 17.

¹³² World Bank, *Global Development Horizons 2011*, 73-75.

Environment 2010 suggests that local and regional organizations will continue to take more of a leadership role in economic, political, and social issues, requiring cooperative engagements and strategies.¹³³

Individual Empowerment. Globalization changes individual expectations, empowerment, identity, and values. Round-the-clock access to information, coupled with the rapid spread of information and misinformation, has sparked an awakening in individual expectations.¹³⁴ Forecasts indicate that individual empowerment will continue to accelerate in the future.¹³⁵ With the explosion of information, choices that are more global may lead to the fracturing of national identity of younger generations.¹³⁶ Increasing cross-border connectedness may lead a nation's youth to identify more with their international contemporaries—adopting and/or sharing their interests, aspirations, and objectives—than with their forebears.

More Complexity. Finally, interconnectedness leads to added complexity of issues facing the world by 2030. Trends in all domains are growing more interrelated, generating feedback loops, cross-domain influences, and second- and third-order effects not previously observed. This complexity requires informed, intelligent leadership to solve problems and crises, but a leadership crisis is also a contemporaneous, emergent trend as the World Economic Forum highlights in *Outlook on the Global Agenda 2015*.¹³⁷ Leadership is at a crossroads in developing solutions to complex global and regional challenges.

Implications

The relative advantages in terms of actual or potential military power, which the developed nations have enjoyed in recent decades, are likely to erode, or at least be more difficult and perhaps costly to maintain. One can view a nation's productive capacity as military potential, because under the right conditions it is possible to translate economic power into military power. The United States and other developed nations have enjoyed an advantage for decades because their much stronger economies, in both absolute and relative terms, enabled them to build and sustain stronger militaries. Trends in GDP growth and per capita GDP growth foreshadow relative decline in the productive capacity and therefore military potential in the developed economies, although the U.S. will be relatively less affected due to its more favorable demographics, economy, resources, and geography. Additionally, the diffusion of economic power and advanced technology will contribute to a security environment populated by a greater number of potential peer or near-peer

¹³³ U.S. Joint Forces Command, *The JOE 2010*, 18.

¹³⁴ Robert A. Manning, *Envisioning 2030: U.S. Strategy for a Post-Western World* (Washington, DC: Atlantic Council, 2012), 8.

¹³⁵ National Intelligence Council, *Global Trends 2030*, ii.

¹³⁶ North Atlantic Treaty Organization, Headquarters, Supreme Allied Commander Transformation, *Strategic Foresight Analysis 2013 Report* (Norfolk, VA: North Atlantic Treaty Organization, 2013), 20.

¹³⁷ World Economic Forum, *Outlook on the Global Agenda 2015*, 14-16.

competitors. Not only will the U.S. be more challenged to maintain its military advantages, but it will also encounter more nations with the capability to compete in the future security environment.

Principal economic trends suggest that the traditional U.S. alliance base will weaken because the productive and revenue-raising capacities of allies will decline in relative terms. All major eurozone economies as measured by GDP will weaken in relative terms. Likewise, Japan's economic ranking in the world will drop as its GDP declines substantially relative to that of developing countries such as China, India, Brazil, and Mexico. By another metric, GDP per capita, the prospects for allies in Europe and Japan appear little different, and although they will maintain an absolute advantage over developing economies, that advantage will deteriorate. At the same time, these traditional U.S. allies will confront requirements to care for aging populations and maintain substantial social welfare expenditures. This combination of trends will continue to pressure defense expenditures of the eurozone nations and Japan. In the coming decades, the United States may need to consider broadening its alliance base and cultivating new security partnerships with nations whose shares of global output are on the rise.

Economic trends also suggest that an increasingly integrated and multipolar global economy could jeopardize social and political cohesion, both within and across national boundaries. Expanding global trade and supply chains increase relationships and dependencies that cross national boundaries as economic actors in one nation develop connections with and rely on one or more economic partners in other nations. As global economic links multiply, it becomes more likely that the interests and priorities of economic actors who benefit most from international trade and finance will align more closely with foreign economic partners than with their neighbors and compatriots who regard global economic integration as more threat than opportunity. Similarly, as national economies integrate more fully with the multipolar global economy, national interests may compel leaders to prioritize new economic partnerships over traditional political partnerships.

Economic trends will strengthen the position of nontraditional competitors in international affairs. The increasing impact of non-economic, non-state actors such as criminal organizations and non-governmental organizations is well documented, but trends also indicate that multinational corporations in both developed and developing economies will grow increasingly powerful. With supply chains and employee populations spanning the globe, operations in multiple countries, and revenues that rival national GDP figures,¹³⁸ multinationals will have increasing international interests and influence.

¹³⁸ For example, Walmart's revenue of \$486 billion (2013) rivals the GDPs (current USD) of Austria at \$428 billion (2013) and Venezuela at GDP of \$438 billion (2013). For Walmart's revenue figure, see Scott DeCarlo, "The World's Biggest Companies," *Forbes*, 17 April 2013, <http://www.forbes.com/sites/scottdecarlo/2013/04/17/the-worlds-biggest-companies-2/> and for the most recent estimates of nominal GDP in current U.S. dollars, see "Data," *World Bank*, accessed 27 February 2015, http://data.worldbank.org/indicator/NY.GDP.MKTP.CD?order=wbapi_data_value_2013+wbapi_data_value+wbapi_data_value-last&sort=desc.

Trends that point toward an increasingly integrated and multipolar global economy also suggest that the effectiveness of economic sanctions as a policy instrument will diminish. The diffusion of economic power resulting from the relative decline of developed economies and the rise of developing economies will provide more options to nations targeted with economic sanctions. They will more easily find alternate sources for needed goods and services.

Individuals, organizations, and nations will need to recognize and cope with rapid change, complexity, and uncertainty in a globalized world. Risks and uncertainties are associated with the high degree of integration between domestic and local markets. As early as 2003, an IMF paper noted that “the proliferation of financial crises is often viewed as one of the defining aspects of the intensification of financial globalization.”¹³⁹ Similarly, citing a number of examples from the past two decades, a 2011 UN Secretary General’s report raised “significant doubts about the alleged benefits of financial globalization.”¹⁴⁰ It is unclear if divergences and increased financial volatility will cause a global financial breakdown or if the development of multiple growth centers will foster the requisite resiliency to avoid one.

Access to information, greater connectedness, and empowerment will afford individuals or small groups with violent intent greater access to lethal or disruptive technologies. Proliferation of advanced technologies will enable the use of smarter, lighter, and smaller machines by more non-state organizations and individuals. A wide range of groups and individuals will leverage 3-D printing, cheap precision location and targeting capabilities, computer and cyber tools, unmanned systems, and advanced biological and chemical capabilities to disrupt society through political violence on a scale that was previously only available to nation-states.

Globalization will continue apace and increasingly affect the future global environment. Economic power is shifting, albeit unevenly, and more players are gaining influence, but increasing integration and multipolarity do not point toward a single, clear-cut future. The trend toward economic multipolarity has the potential to weaken nation-states and longstanding international alliances. Multipolarity in the global economy will often mean that those who aim to impose economic sanctions face competition and obstacles: economic peers or near-peers that possess both the capacity and desire to undermine the economic sanctions for their own economic and/or political benefit.

Ultimately, the dominant economic trends suggest that the United States will face a more nuanced security environment, which can be characterized as follows:

- Relatively more powerful, more diverse competitors;
- Weakened allies, owing to relatively diminished productive capacities;

¹³⁹ Eswar S. Prasad, Kenneth Rogoff, Shang-Jin Wei, and M. Ayhan Kose, *Effects of Financial Globalization on Developing Countries: Some Empirical Evidence*, Occasional Paper 220 (Washington, DC: International Monetary Fund, 2003), 24.

¹⁴⁰ United Nations, General Assembly, *Globalization and interdependence: sustained, inclusive, and equitable economic growth for a fair and more equitable globalization for all, including job creation: report of the Secretary General*, A/66/223 (1 August 2011), 2.

- Increased global economic interdependence, which tends to add complexity and magnify disadvantages inherent in any foreign policy or national security course of action; and
- A smaller, policy-related “tool kit,” given the United States’ reduced economic, financial, and military advantages relative to competitors in the future.

Given the uneven development and prosperity among regions and countries, the U.S. and international institutions must work to develop effective economic and governmental mechanisms to enable enterprise and financial sector reforms without alienating cultural sensitivities. The challenge for policy makers will be to adopt appropriate policies and trade-offs in a rapidly evolving global economy that provide dynamism and openness while retaining a proper degree of equity. Increased complexity with increased interconnectedness will require globally aware leaders capable of developing solutions involving more international players and organizations against more powerful, technologically advanced adversaries.

Governance

The United States will not singularly dominate the future world order. The gaps in economic and political power between more developed and less developed nations, or among the West, East, and South, will likely close. This will provide non-state actors such as corporations and individuals greater influence over governance mechanisms and processes. Smaller countries will likely find that they can be most effective on the global stage by working within blocs, particularly as they become increasingly reliant on other countries for critical supplies of food, water, energy, and materials. Such blocs will form around regional alliances or shared values to meet common interests in a more crowded environment.¹⁴¹ Instability will remain a critical issue as radical movements and criminal elements increasingly challenge government power either directly or in the seams among diffuse power centers. Countries advancing toward democratic governance will be most prone to instability, and that instability will escalate more rapidly, potentially with greater violence. International borders may become less relevant, forcing governments to engage more deliberately and effectively on an international level.

For the purposes of the MCSEF, the term “governance” encompasses “the entire system of formal and informal political arrangements.”¹⁴² It includes the societal basis for decision making, the institutions associated with government, and the resulting domestic and international policies. Unlike “government,” which refers solely to the institutional framework of executive, legislative, and judicial institutions, governance is an inclusive concept referring to the decision-making authority and powers that affect human security.¹⁴³

¹⁴¹ U.K. Ministry of Defence, Development, Concepts, and Doctrine Centre, *Global Strategic Trends—Out to 2045, Fifth Edition* (Shrivenham, UK: Ministry of Defence, 2015), 83.

¹⁴² Center for Emerging Threats and Opportunities, *2014 Edition of Flashpoints* (Quantico, VA: Potomac Institute for Policy Studies, 2014), 7-9.

¹⁴³ *Ibid.*, 9.

In 1941, only 11 countries were democratic.¹⁴⁴ By 2012, the number of electoral democracies reached 118¹⁴⁵—just over 60 percent of all countries. However, the spread of democracy has arguably slowed since 2000. In most established democracies, voter turnout is declining. This trend could conceivably reach a point at which the legitimacy of democratic institutions is challenged. Membership in political parties has also been declining, as has trust in government. Observers sometimes mention the “Beijing Consensus” (a limited free market, with strong central control) as an alternative to the Western democratic model. Still others cite China’s rapidly improving standard of living as proof that its system of governance is more effective. It is noteworthy, however, that democratic Brazil has achieved, proportionally, a similarly impressive feat. Moreover, China’s per capita income remains substantially lower than that of established democracies, and forecasters expect it to remain so through 2045.¹⁴⁶

Despite the progression of democracy in its various forms and the emergence of competing governance models, governance of cities—especially megacities—will be problematic, as detailed in the next section on “Urban Littorals.”

Current State

There is an ongoing trend toward greater diffusion of governmental authority and power. Anne Marie Slaughter, a former Director of Policy Planning for the U.S. Department of State, suggested nearly 20 years ago in a *Foreign Affairs* article that the nation-state is “not disappearing, it is disaggregating into its separate, functionally distinct parts. These parts—courts, regulatory agencies, executives, and even legislatures—are networking with their counterparts abroad, creating a dense web of relations that constitutes a new, trans-governmental order.”¹⁴⁷ While nation-states pass and enforce laws that apply to their citizens, intergovernmental organizations, like the UN, IMF, Organization for Economic Cooperation and Development (OECD), Organization for African Unity (OAU), European Union (EU), World Bank, International Criminal Police Organization (INTERPOL), and International Criminal Court (ICC), provide political, economic, and/or security frameworks among groups and nations sharing common goals. These goals include facilitating international cooperation as well as establishing and enforcing agreed upon regulations and standards.

For complete analysis, one must consider the attributes that enable governance, such as economic power and stability, type of government, propensity for intrastate and interstate violence, and permanence of national boundaries. Analysis of economic indicators and statistics reveals that

¹⁴⁴ “What’s gone wrong with democracy,” *The Economist*, accessed 1 June 2015, <http://www.economist.com/news/essays/21596796-democracy-was-most-successful-political-idea-20th-century-why-has-it-run-trouble-and-what-can-be-do>.

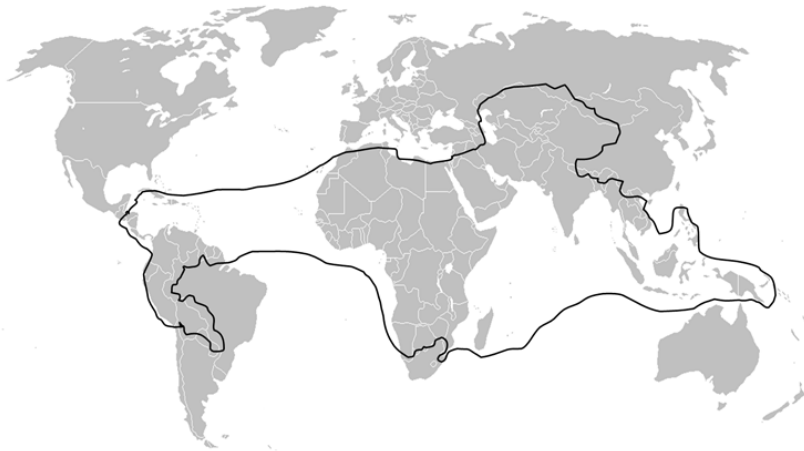
¹⁴⁵ “Freedom in the World 2013: Democratic Breakthroughs in the Balance,” *Freedom House*, accessed 29 May 2015, https://freedomhouse.org/report/freedom-world/freedom-world-2013#.VW8yNDYw_xg.

¹⁴⁶ U.K. Ministry of Defence, *Global Strategic Trends—Out to 2045*, 83.

¹⁴⁷ Anne-Marie Slaughter, “The Real New World Order,” *Foreign Affairs* 76, no. 5 (1997): 183-197.

economic power is shifting from the West to the East and South, with nations such as China, India, Thailand, Singapore, Mexico, and Brazil on the rise. Competition in trade is increasing worldwide

Figure 2-8. The “Arc of Instability”



Source: Thomas P. M. Barnett, *The Pentagon's New Map: War and Peace in the Twenty-First Century* (New York: G. P. Putnam's Sons, 2004), inside front cover.

with developing countries gaining a greater share of global economic power, although at a slower rate than today's developed nations did during their developing periods.¹⁴⁸ International commerce, defined as commerce between states or nations foreign to each other,¹⁴⁹ has increased dramatically and has become the foundation of economic growth and stability in many developing countries. Complexity and instability result from these economic and governance power shifts.

Extremism, revolution, and insurgency have become the modern day formulae for change. Recent examples of extremists taking advantage of evolving power relationships and increased instability include the Islamic State in Iraq and the Levant (ISIL),¹⁵⁰ the violent insurgency in the Central African Republic,¹⁵¹ and Boko Haram in Nigeria.¹⁵²

Instability is also present in countries that are transitioning from autocracies to democracies. The NIC's *Global Trends 2030* report places numerous countries in the “transitioning” category, which exposes them to added risk of instability. These countries largely align with the “arc of instability”¹⁵³ (see figure 2-8) across sub-Saharan Africa, the Middle East, Asia, and Southeast Asia.¹⁵⁴

¹⁴⁸ For more detailed discussion of economic power and its relationship to other forms of power, and to governance, see the section on “Globalization” in chapter 2 of this document. Additionally, the last five editions of the NIC's *Global Trends* and the last several editions of the World Economic Forum's *Outlook on the Global Agenda* also contain worthwhile discussions of the topic. For example, see National Intelligence Council, *Global Trends 2030: Alternative Worlds*, 15-19.

¹⁴⁹ “International Commerce,” *Black's Law Dictionary*, accessed 25 May 2015, <http://thelawdictionary.org/international-commerce/>.

¹⁵⁰ “Islamic State in Iraq and the Levant (ISIL),” *Encyclopaedia Britannica*, accessed 25 May 2015, <http://www.britannica.com/EBchecked/topic/1963547/Islamic-State-in-Iraq-and-the-Levant-ISIL>.

¹⁵¹ “Violence in the Central African Republic,” *Council on Foreign Relations*, accessed 25 May 2015, <http://www.cfr.org/global/global-conflict-tracker/p32137?marker=26#!/?marker=26>.

¹⁵² John Campbell, “Nigeria Security Tracker: Mapping Violence in Nigeria,” *Council on Foreign Relations*, accessed 13 May 2015, <http://www.cfr.org/nigeria/nigeria-security-tracker/p29483>.

¹⁵³ The term “arc of instability” describes “a great arc of instability stretching from sub-Saharan Africa through North Africa, into the Middle East, the Balkans, the Caucasus, and South and Central Asia, and parts of Southeast Asia.” Some interpretations also include parts of the Caribbean and Central America. See Graeme Dobell, “The ‘Arc of Instability’: The

(note continued)

There is ample evidence of extremist organizations exploiting porous borders and governance seams and operating effectively from regions with ill-defined governance boundaries. Boko Haram is active in Nigeria, Chad, Niger, and northern Cameroon; Al-Shabaab operates primarily in Somalia but capitalizes on support in Eritrea and Somaliland; ISIL has expanded beyond the borders of Syria to Iraq, Turkey, and Lebanon; and Hezbollah is active in Lebanon, Syria, and Cyprus, with some cells in neighboring nations. Although tactically some fronts end at a border in distinct locations, it is not due to conscious decisions made by the radical leadership to constrain their operations within borders. With instability no longer confined by borders, governance is not purely a national affair.

Principal Patterns and Trends

Instability and Transnational Conflict. The state will remain the dominant actor in international affairs, although the world is experiencing a diffusion of power that will continue to affect governance. Analysts expect that shortcomings in the ability of national systems to govern will continue and possibly accelerate in the future.¹⁵⁵ The underpinnings of the post-Cold War equilibrium are shifting. During the next 15-20 years, the U.S. will be grappling with the degree to which it can continue to play the role of systemic guardian and guarantor of the global order. A reduced U.S. willingness and/or capacity to serve as a global-security provider would be a key factor contributing to instability, particularly in Asia and the Middle East. A more fragmented international system in which existing forms of cooperation are no longer seen as advantageous to many of the key global players would also increase the potential for competition and possibly even great power conflict. However, if a great power conflict occurs, it may not rise to the level of armed conflict and almost certainly will not be on the level of a world war with all major powers engaged.¹⁵⁶

Globalization catalyzes instability in a way that renders established borders increasingly irrelevant and accelerates the escalation of violence. Globalization is likely to lead to increasing constraints on countries' freedom of action, with countries likely to become more economically and politically interdependent. Large private, or semi-private, companies and non-governmental organizations will likely grow in number and power, seeking to influence national and international decisions. Some multinational corporations are already worth as much financially as some national economies, with 12 multinational corporations among the top 100 economies.¹⁵⁷

Non-government entities are not likely to exercise state-like legal and decision-making powers but the diffusion of power is contributing to more frequent and aggressive challenges to

History of an Idea," in *History as Policy: Framing The Debate on the Future of Australia's Defence Policy*, eds. Ron Huiskens and Meredith Thatcher (Canberra AU: ANU E Press, 2007), 87-88 and National Intelligence Council, *Global Trends 2025: A Transformed World* (Washington, DC: U.S. Government Printing Office, 2008), 61.

¹⁵⁴ National Intelligence Council, *Global Trends 2030*, 51-53.

¹⁵⁵ *Ibid.*, vii.

¹⁵⁶ *Ibid.*, viii.

¹⁵⁷ U.K. Ministry of Defence, *Global Strategic Trends—Out to 2045*, 88.

traditional power centers by international organizations, corporations, individuals, and radical movements. These challenges in many cases breed instability, especially for governments transitioning toward democracy. Creating a democracy after autocratic rule is usually a long, messy process, often inhibited by competition from independent militias and other political or non-government entities. The goal is the creation of a government that is equitable and legitimate. Often, however, the transition does not proceed as intended, and another autocratic regime may succeed the failed democratic transition, creating a cycle of persistent, predictable instability.

Instability involving violent and brutal sectarian clashes will escalate more quickly and spread farther, possibly intensifying to ethnic cleansing and genocide. Nations racked by instability, violence, and civil war may revert to a very basic level of governance and vent their frustration or exact their revenge on members of competing ethnic or religious groups. Poor governance, a lack of security organizations, and the collapse of the rule of law and the judicial system can all contribute to sectarian violence. Age-old hatred and grievances will continue to percolate in contested areas that are poorly governed.

Relative Power Shift. Great powers remain the principal actors in international affairs. Their influence extends well beyond their borders, shaping world political decision making with the goal of influencing events to support their own national interests.¹⁵⁸ Balancing against a single adversary, the Soviet Union, during the Cold War was a simple task for the West. The unipolar system that followed posed new major international challenges in power distribution and decision making. Some scholars and policy makers argue that considerable evidence indicates that power politics is still the driving force behind the foreign policy decisions of major European and East Asian countries.¹⁵⁹ The NIC contends that by 2030 no country will be a hegemonic power.¹⁶⁰ History suggests that a more equal distribution of power will produce fluid alignments, not fixed alliances.

Robert Kagan, a fellow at the Brookings Institution, believes that U.S. primacy is undiminished and that Americans, as long as they set their minds to it, are poised to sit atop the global pecking order for the indefinite future. He maintains that only China will seriously contest U.S. interests. Other powers will either align with the U.S. or remain on the geopolitical sidelines. The biggest threat to U.S. hegemony is, as Kagan notes, "Americans may convince themselves that decline is indeed inevitable—and choose to let it happen."¹⁶¹ Charles A. Kupchan, on the other hand, argues that power is undeniably flowing away from the West to developing nations and that the worst thing to do is to pretend it is not happening.¹⁶²

¹⁵⁸ See Charles A. Kupchan, *The End of the American Era: U.S. Foreign Policy and the Geopolitics of the Twenty-first Century* (New York: Alfred A. Knoff, 2003).

¹⁵⁹ Arpiné Kocharyan, "Balancing between Great Powers in the 21st Century" (thesis, Hartwick College, 2005), 8-9.

¹⁶⁰ National Intelligence Council, *Global Trends 2030*, iii.

¹⁶¹ Charles A. Kupchan, "The Decline of the West: Why America Must Prepare for the End of Dominance," *Atlantic Magazine*, 20 March 2012, <http://www.theatlantic.com/international/archive/2012/03/the-decline-of-the-west-why-america-must-prepare-for-the-end-of-dominance/254779/>.

¹⁶² Ibid.

Economic power is a leading indicator of political power,¹⁶³ and economic power will continue to shift from the West to the East and South. In 2010, four of the top five economies in the world were still from the developed world (i.e., United States, Japan, Germany, and France). From the developing world, only China ranked in the top five, coming in at number two. Forecasters expect the global economic power structure to shift by 2045. According to Goldman Sachs, for example, four of the top five economies will come from today's developing world: Brazil, Russia, India, and China (the BRIC nations), and only the United States will make the top five from the current developed world, ranking second with an economy about half the size of China's.¹⁶⁴ While several forecasts take a similar view with regard to Russia's future economic power, it should be noted that, in a difference of opinion, the NIC predicts that its current relative demographic and economic decline will impede Russia from re-emerging as a major geopolitical player, and from maintaining a sphere of influence over Central Asia. States such as Indonesia, Iran, South Africa, Mexico, and Turkey with middle tier developing economies, will rise by 2030. Japan, an economic powerhouse with an aging population and a shrinking workforce, likely will decline to an upper-middle power ranking.¹⁶⁵ Europe is likely to remain a substantial part of the global economy, with the euro and the single market still likely to exist through 2045. EU membership is likely to expand, although it is unlikely that all countries who wish to join will be included and some current members may leave.¹⁶⁶ In 2030, the EU as an economic entity will rival the U.S. and India, but only Germany, France, and the United Kingdom will be ranked individually in the top 10 economies.¹⁶⁷

Global Networks. Non-state actors, including multinational corporations, will exert greater influence over existing national governments and international institutions.¹⁶⁸ As the relative power of the nation-state declines, the influence of intergovernmental organizations, nongovernmental organizations, and businesses—especially multinational corporations—will expand. Nation-states will remain the most influential players, but regional and non-traditional organizations will play an increasingly larger role. Civil society and aid organizations will act globally by forming alliances with organizations in other countries, using advanced technology and telecommunications and lobbying international organizations and other actors directly instead of working through their national governments.

Even small- and medium-size, high-growth firms from developing countries will have more global reach. Consequently, the influence of corporations on communities, on the lives of citizens, and on the environment will continue to increase. This fundamental shift in global power means

¹⁶³ Gregory F. Treverton and Seth G. Jones, *Measuring National Power* (Arlington, VA: RAND Corporation, 2005), 3-8.

¹⁶⁴ Kupchan, "The Decline of the West."

¹⁶⁵ Treverton and Jones, *Measuring National Power*, 16.

¹⁶⁶ U.K. Ministry of Defence, *Global Strategic Trends—Out to 2045*, 117.

¹⁶⁷ Brian Wang, "World Economies in 2030," *Next Big Future*, 22 September 2012, <http://nextbigfuture.com/2012/09/world-economies-in-2030.html>.

¹⁶⁸ National Intelligence Council, *Global Trends 2030*, 51.

that communities and citizens will progressively target corporations with requests for assistance and with criticism for failure, just as they currently do with formal governments.

Radical movements and criminal organizations will continue to challenge the power of nation-states, particularly in environments where corruption is pervasive and governance is ineffective. Political and economic inequality, unrealized expectations, perceptions of corruption, and disillusionment with the status quo can aggravate ethnic and religious divisions, further eroding the power of the state. In a connected world, access to transportation and modern communications will enable criminal and terrorist organizations to form global alliances of convenience. Drug cartels and other criminal organizations do not recognize borders, and their ability to operate across the seams of power challenges both national and international enforcement efforts.

Individual Empowerment. A state's freedom of maneuver can be constrained by an increasingly connected public with greater awareness of current issues and global events. Enabled by advancing technology and telecommunications, increasing individual empowerment will continue to contribute to the diffusion of power. Individuals and small groups with specific agendas can harness near-instantaneous communications to bring together large crowds to challenge the authority of the state. While developing countries are growing more connected, individual empowerment will develop more slowly in the most impoverished regions.

Particularly in developing countries, many people may feel more closely bound by tribal allegiances or other loyalties than connected to the state. Given the advantages that modern transportation and advanced telecommunications afford to small groups and individuals, existing borders will be less relevant. Arbitrarily established during periods of colonial rule, many of these borders will be increasingly ignored or changed due to geographic, ethnic, religious, or tribal concerns. Whether due to religious, ethnic, or tribal sectarian violence, it is reasonable to expect more border-agnostic conflict in the future. The state may be less relevant to the individual, due to the movement of people, information, and ideas across national boundaries. If individuals feel less connected to the state, they are also likely to become less interested in supporting it.¹⁶⁹

Implications

The private sector and other non-state organizations are likely to grow more influential. National governments and global institutions will need to be more adaptive, relevant, and responsive in an environment where power is more diverse and distributed. The growing influence of non-state actors does not suggest that states are unimportant; it merely adds to the complexity of governing. Despite the likelihood of power being more distributed in the future, alternative power centers such as international organizations, multinational corporations, religious groups, or criminal cartels will be no substitute for state power in many situations. Consumer boycotts of transnational corporations that are destroying rain forests or exploiting child labor may have an

¹⁶⁹ Robert Cooper, *The Breaking of Nations: Order and Chaos in the 21st Century* (London: Grove Press, 2004), 16-54.

impact, but environmentalists or labor activists will likely prefer national legislation, which establishes standards that mandate control over these issues, to less effective international regulations. However, many state institutions suffer from bureaucratic inertia and competing priorities, resulting in resistance to change.

Nongovernmental organizations (NGOs), multinational corporations, and other groups accustomed to cooperating across borders will excel in a globalized world where agility, expertise, and influence are more relevant than an official government position. Philanthropic NGOs with access to private capital can be more responsive than many state-funded development programs. Access to data and information on a grand scale will enable non-state actors and private companies to influence behavior, often competing with nation-states. State institutions, to be effective, will have to learn to work with these non-state entities.

Individuals or small groups with violent intent may be able to work across multiple governance seams to gain access to lethal or disruptive technologies. Emerging technologies could enable individuals, violent extremists, criminals, or other organizations to conduct large-scale violence, broadly disrupting society. Transnational crime has evolved to a degree that it undermines governance, disrupts free markets, drains national assets, and inhibits the development of stable societies. State and non-state entities will have to work together to address these political, economic, social, and criminal issues.

The multiplicity of players involved in coordinating solutions to global and regional issues adds significant complexity. With the empowerment of the individual and the spread of information and misinformation on social media, critiques of, and resistance to, solutions may hamper execution before success is possible. Additionally, the decreasing relevance of borders adds complexity that can lengthen the negotiation and implementation of solutions at a time when processes need to be shorter to be effective.

Overall, trends indicate that governments must adjust their processes to keep up with the changes brought by increased complexity, diffused power, and more numerous and diverse technology-enabled players vying for power. Traditional leaders, who are often reluctant to change, will need to adapt governance processes by streamlining them and widening access to retain their legitimacy. Combined with trends related to technology and globalization, governance-related trends appear to enhance the value of a whole-of-government approach to solving national and international problems in an increasingly complex and interconnected world. But this multidisciplinary approach requires substantial improvement in both national and transnational environments to ensure it delivers timely, effective, and efficient results.

Urban Littorals

Urbanization involves both the transformation of rural areas to industrial areas and population migration from rural to urban areas. Urbanization can describe a specific condition at a given time, such as the proportion of total population or area in cities or towns, or the term can describe the

increase of this proportion over time predominantly resulting in the physical growth of urban areas, whether horizontal or vertical. It is not merely a modern phenomenon, but a rapid and historic transformation of human social roots on a global scale whereby predominantly rural culture is being rapidly replaced by predominantly urban culture. Compared to the historical experiences of the western world, today's most rapidly urbanizing developing states are changing at "100 times the scale, in one tenth of the time."¹⁷⁰

Webster's Dictionary defines littoral as follows: "of, relating to, or situated or growing on or near a shore, especially of the sea." Littoralization is a geographic process by which populations and economic activities come together in the littoral environment.¹⁷¹ According to *Command and Control for Joint Maritime Operations*, Joint Publication 3-32, and *Department of Defense Dictionary of Military and Associated Terms*, Joint Publication 1-02, the littoral "comprises two segments of operational environment: 1. Seaward: the area from the open ocean to the shore, which must be controlled to support operations ashore. 2. Landward: the area inland from the shore that can be supported and defended directly from the sea."¹⁷²

Among the politically significant urban areas around the world, 60 percent are located within 40 kilometers of a coastline and 75 percent are within 240 kilometers of a coastline. Coastlines or coastal deltas serve as host to 8 of the world's 10 largest cities. A significant and growing portion of the world's population lives within 160 kilometers of a coastline.¹⁷³ The phenomenon of increased urbanization in the littorals is likely to continue.

Current State

The share of the world's population located in urban areas continues to grow.¹⁷⁴ In 1950, there were 83 cities with populations exceeding 1 million; by 2007, this number had risen to 468. The United Nations forecasts that today's urban population of 3.2 billion will rise to nearly 5 billion by 2030 and 60 percent of people will live in cities. This increase in urban populations will be most dramatic in Asia and Africa, particularly in their developing countries. Additionally, one billion people, or almost one-seventh of the world's population, live on the periphery of cities in slums with little security and poor employment prospects; this number is expected to double to almost two

¹⁷⁰ Jaana Remes, "Megacities, Global Security, and the Map of the Future," *Wilson Center*, webcast video, 20 March 2012, <http://www.wilsoncenter.org/event/megacities-global-security-and-the-map-the-future>.

¹⁷¹ Eamonn Fitzgerald, "Word of the Year: littoralization," *eamonn.com* (blog), 20 November 2013, <http://www.eamonn.com/2013/11/20/word-of-the-year-littoralization/>.

¹⁷² U.S. Department of Defense, *Department of Defense Dictionary of Military and Associated Terms* (Joint Pub 1-02) (Washington, DC: U.S. Department of Defense, 2014), 156.

¹⁷³ U.S. Department of Defense, *Joint Urban Operations (Joint Publication 3-06)* (Washington, DC: U.S. Department of Defense, 2013), E-1.

¹⁷⁴ In 1800, only 3 percent of the world's population lived in cities, a figure that rose to 47 percent by the end of the twentieth century and exceeded 50 percent by 2008.

billion by 2035.¹⁷⁵ In many poor countries, overpopulated slums exhibit high rates of disease due to malnutrition, unsanitary conditions, and lack of basic health care.

Around these dense cities, peri-urban areas—zones of transition from rural to urban land uses—exist between the outer limits of urban and regional centers and the rural environment. Development of peri-urban areas involves the conversion of rural lands to residential use, closer subdivision, fragmentation, and a changing mix of urban and rural activities and functions. The boundaries of peri-urban areas are porous and transitory as urban development extends into rural and industrial land.¹⁷⁶

Density is an overriding aspect of the urban environment—density of structures, density of people, and density of infrastructure. Dense urban geography changes the nature of spatial and temporal relationships and our understanding of them. Critical infrastructures (e.g., physical, economic, governmental, and social) are in such close proximity and, in most areas, so intertwined that even minor disruptions can cause significant repercussions. The urban geography seemingly compresses distances, often limiting line of sight to only a few meters. It also contains an apparent spatial dichotomy. On one hand, a very small area can contain a large opposing force and a large number of neutrals arrayed in three-dimensional depth. On the other hand, a relatively small area can swallow up a large force intervening to eject an adversary, resolve a crisis, or restore stability.

Current urbanization growth is almost exclusively clustered in littoral, or coastal, areas within a few dozen kilometers of the sea. There are 136 port cities around the world with more than 1 million inhabitants. As the OECD¹⁷⁷ notes, “Most of these large port cities are found in Asia (38%), and many of them (27%) are located in deltaic settings, again mainly in Asia.”¹⁷⁸ In fact, 14 of the world's 17 largest cities are located in the littorals and 40 percent of cities with populations of 1 million to 10 million people are located near coastlines.¹⁷⁹

Principal Patterns and Trends

There is no widely circulating work available on the rise of the 21st century megacity,¹⁸⁰ despite its rapid emergence on the global stage and its attendant global security implications. While

¹⁷⁵ United Nations Human Settlements Programme, *The Challenge of Slums: Global Report on Human Settlements 2003* (Sterling, VA: Earthscan Publications Ltd, 2003), xxv.

¹⁷⁶ “Peri-Urban 2014 Conference, University of Western Sydney, Parramatta Campus, NSW, July 2014,” *Australian Water Association*, accessed 19 February 2015, <http://periurban14.org/>.

¹⁷⁷ The OECD, Organization for Economic Cooperation and Development, is an international economic organization of 34 nations founded in 1961 to stimulate economic progress and world trade.

¹⁷⁸ R. J. Nicholls et al., *Ranking of the World's Cities Most Exposed to Coastal Flooding Today and in the Future* (Paris: Organization for Economic Cooperation and Development, 2007), 4.

¹⁷⁹ John Tibbetts, “Coastal Cities: Living on the Edge,” *Environmental Health Perspectives* 110, no. 11 (2002): 674-681.

¹⁸⁰ A city with an urban population exceeding 10 million is a “megacity” according to convention. Some definitions also set a minimum level for megacity population density (e.g., at least 2,000 persons per square kilometer). A megacity can be a single metropolitan area or two or more metropolitan areas that converge. According to the UN, “For a number of cities, the data available refer to two concepts: the city proper as defined by administrative boundaries and its metropolitan

(note continued)

specific case studies do exist of some megacities—for example, James Pick and Edward Butler’s *Mexico Megacity* and Christopher Silver’s *Planning the Megacity: Jakarta in the Twentieth Century*—these works retain a highly specialized focus on landscape design and environmental impact. One of the few works to consider the broader implications of urban growth is Norman Myers’ *The Gaia Atlas of Future Worlds: Challenges and Opportunities in an Age of Change*, published in 1991. He identified the “termite queen phenomenon,” in which urban centers, acting as a kind of “supernest,” attract resources—both positive and negative—from rural centers, including human capital and labor, skills, food, water, and raw materials. Myers’ projections, while fascinating, are now decades old. New events, trends, effects, and phenomena have emerged.¹⁸¹

In 1950, there were two urban agglomerations with populations over 10 million: New York-Newark with 12.3 million inhabitants and Tokyo with 11.3 million inhabitants. These were the first megacities. London ranked third with a population of 8.4 million.¹⁸² This trio formed the core of what Saskia Sassen, the U.S. sociologist, called the “global cities”—urban centers that asserted their power not through empire but through economic influence. The wealth of the world passed through these cities—even if only on paper—and they expanded rapidly as people crowded in for a share of the opportunity.

Twenty-five years passed before the number of megacities doubled by 1975 to 4: Tokyo with 26.6 million inhabitants; Osaka, 16.3 million; New York-Newark, 15.9 million; and Mexico City, 10.7 million. The number of megacities more than doubled again by 1990 to 10, this time after only 15 years. The trend continued, and UN data reflected 20 megacities in 2005.¹⁸³ In 2015, the United Nations counts 29 cities with populations over 10 million—megacity status. Additionally, by the end of 2015, there will be 600 cities with populations of 1 million or more, including 58 with populations over 5 million.

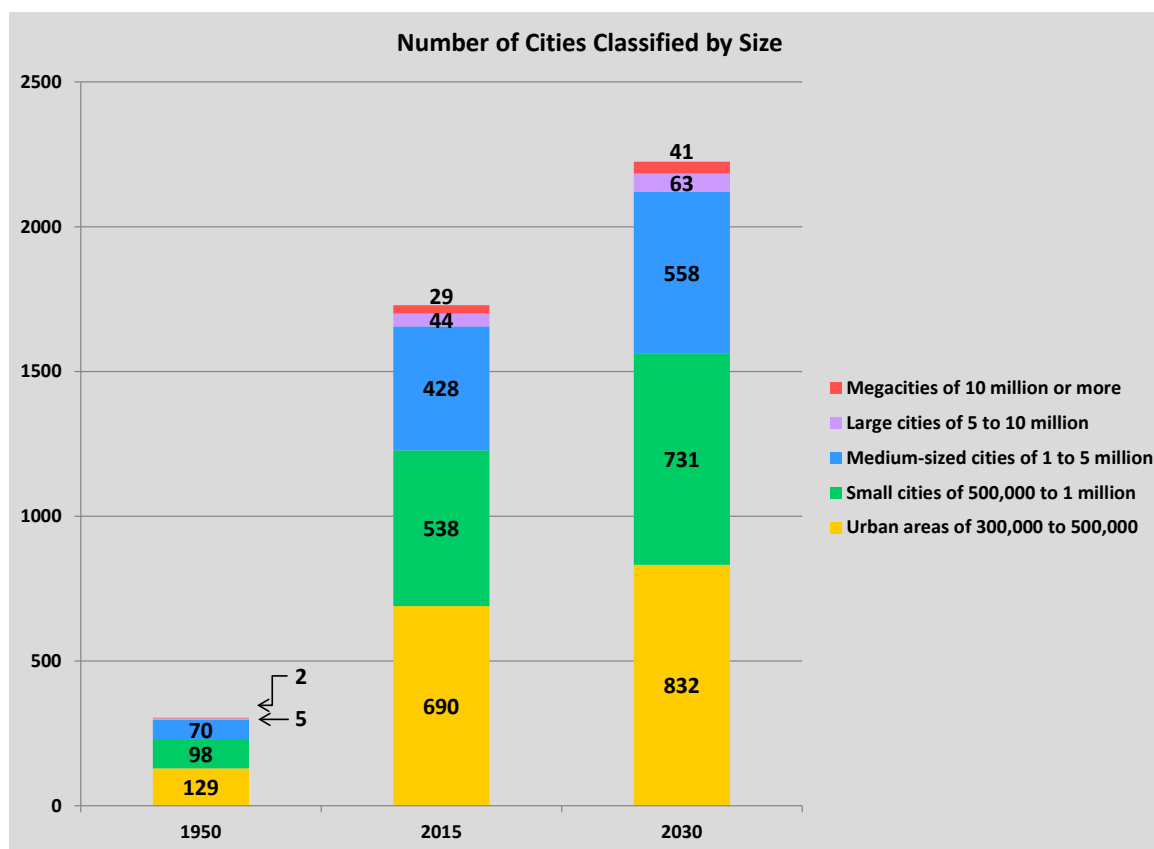
area. In those instances, the data referring to the metropolitan area were usually preferred because they are thought to approximate better the territory associated with the urban agglomeration.” See United Nations, *World Urbanization Prospects: The 2014 Revision*, 5 and “How Big Can Cities Get?” *New Scientist Magazine* 190, no. 2556 (2006): 41.

¹⁸¹ For a complete discussion, see P.H. Liotta and James F. Miskel, “Megacities: The Past, Present and Predictions for the Future,” *Utne*, accessed 20 February 2015, <http://www.utne.com/politics/megacities-ze0z1209zwar.aspx>.

¹⁸² United Nations, Department of Economic and Social Affairs, Population Division, “File 11a: The 30 Largest Urban Agglomerations Ranked by Population Size at Each Point in Time, 1950-2030,” *World Urbanization Prospects: The 2014 Revision*, accessed 12 May 2015, <http://esa.un.org/unpd/wup/CD-ROM/>.

¹⁸³ Ibid.

Figure 2-9. Worldwide Growth of Megacities and Urban Agglomerations



Data Source: United Nations, Department of Economic and Social Affairs, Population Division (2014), *World Urbanization Prospects: The 2014 Revision, Highlights* (ST/ESA/SER.A/352), "File 17b: Number of Cities Classified by Size Class of Urban Settlement, Major Area, Region and Country, 1950-2030"

By 2030 according to the UN, there will be 41 megacities¹⁸⁴ (see figure 2-9). North America and Europe together will count only five megacities: New York-Newark, Los Angeles-Long Beach-Santa Ana, Moscow, Paris, and London. Every other megacity will be in what is referred to as the "global south,"¹⁸⁵ which also corresponds roughly, though not perfectly, with the community of developing countries. To earn a place in the top 10, metropolitan areas will soon need to record

¹⁸⁴ United Nations, *World Urbanization Prospects: The 2014 Revision*, 13.

¹⁸⁵ According to the Center for the Global South at American University, the nations of Africa, Central, and Latin America, as well as most of Asia, are collectively known as the "Global South." They include nearly 157 of 184 recognized states in the world, and many have less developed or severely limited resources. The people of these nations also withstand the worst of some of the greatest challenges facing the international community: poverty, environmental degradation, human and civil rights abuses, ethnic and regional conflicts, mass displacements of refugees, hunger, and disease. See "Did You Know?" *American University*, accessed 17 February 2015, <http://www1.american.edu/academic.depts/against/cgs/about.html>.

populations upwards of 20 million, and 12 conurbations,¹⁸⁶ such as Tokyo, Delhi, Shanghai, Sao Paulo, Mumbai, and Mexico City, will have passed this threshold by 2030.¹⁸⁷ These represent a new breed of city—the metacity.¹⁸⁸ A metacity is defined as a heterogeneous, dynamic urban region composed of multiple dense centers, intervening suburbs, embedded green spaces, and diffuse boundaries between traditional cities, suburbs, and exurbs. Governance in metacities is polycentric: it is shared among different jurisdictions and with formal and informal social institutions.¹⁸⁹ Or, as the United Nations has phrased it, the world's megacities are merging to form vast "mega-regions" which may stretch hundreds of kilometers across countries and be home to more than 100 million people.

Three readily identifiable future trends with respect to urbanization and littoralization, as well as the declining rate of population growth, are significant for developments later in the century and the future security environment.

Rapid Urbanization. Urbanization will continue at a very rapid pace with from 66 percent to 75 percent of the world's population living in urban areas by 2050.¹⁹⁰ This fast-paced urbanization will induce multiple economic, political, social, and cultural changes, notably global wealth distribution. The middle class grows predominantly out of cities. Labor and capital, industry and government, all co-located, enable innovation in technology and other endeavors. Additionally, urbanization diffuses power. Many megacities may not be responsive to state or federal governments simply because of their size. In large urban areas, especially where central government control is weak, influential non-state actors, including local gangs, crime syndicates, and terrorist organizations, are likely to emerge. Within their "territory," extra-governmental forces may establish their own "shadow" *de facto* governments to include policing functions.

Urban Privation. Urbanization is becoming the face of global inequality and poverty, and this trend is likely to continue. For the most part, migrants to urban areas seek a better life and economic opportunities. Also, urbanization, in most places, lowers poverty over time. However, with one billion people living in urban slums today and the expectation that that number will double by 2035,¹⁹¹ increased urbanization creates a huge problem for local, regional, and national governments. Slum formations, for the most part, are unplanned, and the result of multiple failings: growth exceeding capacity; a lack of suitable housing, transportation, electricity, sanitation, and

¹⁸⁶ Conurbations are extensive urban areas resulting from the expansion of several cities so that they coalesce but usually retain their separate identities.

¹⁸⁷ United Nations, *World Urbanization Prospects: The 2014 Revision*, 13.

¹⁸⁸ Edwin Heathcote, "From megacity to metacity," *Financial Times*, 6 April 2010, <http://www.ft.com/cms/s/0/e388a076-38d6-11df-9998-00144feabdc0.html#axzz3TXt24hsD>.

¹⁸⁹ Brian P. McGrath and Steward T.A. Pickett, "Metacity," *Baltimore Ecosystem Study Urban Lexicon* (blog), 11 June 2012, <http://besurbanlexicon.blogspot.com/2012/06/metacity.html>.

¹⁹⁰ United Nations, *World Urbanization Prospects: The 2014 Revision*, 7.

¹⁹¹ United Nations Human Settlements Programme, *The Challenge of Slums*, xxv.

potable water; and ineffective policing and government management. Consequently, the benefits of urbanization and globalization tend to bypass the urban poor.

Urban Areas as Migration Destinations. Cross-border migration of economic refugees to urban areas is likely to continue but stabilize, while domestic migration fueling urban growth is likely to increase. This migration will bring with it diverse racial, ethnic, and religious groups that may or may not be able to assimilate peacefully into the urban society they enter. As groups migrate to the cities, the potential for xenophobia, sectarian strife, or ethnic violence may increase.

A demographic trend merits additional attention here as it relates to urbanization. Although the world's population is still growing overall, the rate of population growth is declining worldwide. Moreover, demographic trends vary widely across regions; in general, developing country populations will continue to increase, while many developed countries will actually experience declining populations during the forecast period (2030-2045). The populations of most European countries will decline in the next generation, and in the cases of Germany and Russia, the decline will be dramatic. In virtually all societies the birthrate among women has been declining. In the advanced industrial world, the fertility rate is already well below 2.1.¹⁹² In mid-tier countries such as Mexico and Turkey, the fertility rate is falling but will not reach 2.1 until between 2040 and 2050. In the poorest countries, such as Bangladesh and Bolivia, the birthrate is also falling, but it will take most of this century to reach 2.1.

Declining fertility seems essentially irreversible, for it is in many regards a byproduct of urbanization. In agricultural and low-level industrial societies, children are a productive asset; they benefit families as a source of simple agricultural or workshop labor. In this context, children become a source of income, and they have significant economic value for families. In an urban society, the economic value of children declines; they turn from instruments of production into drivers of consumption. Children cost a tremendous amount of money with limited tangible economic return; thus, urban families typically have fewer children. Birth control merely provides the means for what seems an economic necessity.¹⁹³

Implications

Analysis of trends related to the urban littorals yields at least three implications for the future security environment. First, rapid urbanization will exert greater and greater strain on what by 2030 will probably already be fragile state and societal networks. Lack of infrastructure, services, employment, and basic governance capacity will likely engender social and political unrest. High potential for unrest, crime, violence, and terror recruitment will originate in areas where the poor congregate and emanate outward from poverty-stricken regions. Poorly governed and unsupported

¹⁹² To maintain population stability, the fertility rate must remain at 2.1 births per woman. Above that, the population rises; below that, it falls. See the "Demographic" section of this chapter for further detail and discussion.

¹⁹³ George Friedman, "Population Decline and the Great Economic Reversal," *Stratfor*, 17 February 2015, <https://www.stratfor.com/weekly/population-decline-and-great-economic-reversal>.

urban areas may become havens for transnational criminal and terror organizations. Unsanitary and overcrowded conditions create public health, disease, and potential pandemic challenges that may exceed the response abilities of authorities.

The implications for urbanization around the Asian littoral constitute a second area of concern. The United Nations forecasts that China alone will have 7 megacities and 16 large cities by 2030, the latter defined as those with populations between 5 and 10 million. India will also have 7 megacities by 2030, as 4 of its cities presently with 5 to 10 million inhabitants become megacities in the coming years. Beyond China and India, Asia will count 10 megacities and 17 large cities by 2030.¹⁹⁴ Extreme weather and natural disasters combined with the ever-increasing migration of populations to the littorals will expose a larger and larger portion of the world's population to the challenges of living in a stressed urban environment. As a result, the human toll of natural disasters will intensify, and the capability and capacity requirements for humanitarian assistance and disaster relief (HA/DR) operations will increase.

Finally, military and peacekeeping operations in the urban littoral environment will be increasingly difficult and, depending on the mission, increasingly dangerous. The high rate of urban growth, coupled with the unplanned growth of settlements, slums, and peri-urban areas, will make it difficult to forecast conflict. Despite otherwise poor living conditions, most urban areas will have high rates of connectivity, which will enhance the ability of insurgent groups and other non-state actors to coordinate their actions, while complicating the security environment that police and security forces will face. Urban connectivity will make it difficult for intervention forces, whether domestic or foreign, to operate without being under constant observation and reporting. Virtually anyone in the urban environment can be a scout, witting or otherwise, for one organization or another. Urban density will impede maneuver. The complexity of large cities will create a plethora of overlapping and multi-interested actors, further increasing the difficulty of conducting military operations in an urban environment. The diffusion or democratization of technology will empower non-state actors with state-of-the-art technology that will likely include sophisticated and relatively cheap weaponry.

As Sydney Freedberg, Jr. expressed in his May 2014 article in *Breaking Defense* titled, "Army Grapples with Cyber Age Battles in Mega-cities":

High-tech warfare at knife-point range...imagine a mega-city of 10 or 20 million, where the slums have more inhabitants than some countries...where suspicious locals post every U.S. military movement on Twitter with digital photos and GPS-precise coordinates. Imagine roadside bombs that fly because the bad guys downloaded blueprints for a kamikaze mini-drone and built it with their 3-D printer.

¹⁹⁴ United Nations, *World Urbanization Prospects: The 2014 Revision*, 14 and United Nations, Department of Economic and Social Affairs, Population Division, "File 17b: Number of Cities Classified by Size Class of Urban Settlement, Major Area, Region and Country, 1950-2030," *World Urbanization Prospects: The 2014 Revision*, accessed 12 May 2015, <http://esa.un.org/unpd/wup/CD-ROM/>.

With the rise of massive urban centers, particularly in Africa and Asia, cities that will pose the greatest challenges in the 21st century are located in less-developed, struggling states. A number of these megacities are located in nations often unable or unwilling to manage the challenges that their vast and growing urban populations pose. Some of these megacities will pose the most significant security threats in the coming decades. They may become havens for terrorists and criminal networks, as well as sources of major environmental degradation. If inept or uncaring governments leave the crowded masses within these unaccommodating spaces to their own devices, their collective rage, despair, and hunger will inevitably erupt.¹⁹⁵ Some of the littoral megacities of greatest concern lie in or close to the so-called “10/40 Window,”¹⁹⁶ an area predominantly in the eastern hemisphere between 10 and 40 degrees north latitude and similar to the arc of instability (see figure 2-8). This area demarcates regions where socioeconomic challenges are the most daunting and where over 65 percent of the world’s population and over 80 percent of the world’s poor live.

The majority of future threats and opportunities will be in the congested and diverse areas where the sea and land merge: the littorals. Most maritime economic activities—commercial shipping, fishing, and oil and gas extraction, for example—take place within 320 kilometers of the shore. Additionally, a significant and growing portion of the world’s population currently resides within 160 kilometers of a coastline. In many cases, threats to our interests may require expanding the concept of littoral maneuver to hundreds of kilometers inland to resolve crises. As such, geography, demographics, and urbanization point toward a future security environment with a significant littoral dimension.¹⁹⁷

This suggests that crises and contingencies will draw U.S. forces into the urban environment. David Kilcullen probably summed it up best when he wrote:

The megatrends of population growth, urbanization, littoralization, and connectedness suggest that conflict is increasingly likely to occur in coastal cities, in underdeveloped regions of the Middle East, Africa, Latin America, and Asia, and in highly networked, connected settings. We’re still likely to experience wars between nation-states, and conflict in remote areas such as mountains, jungles, and deserts will still undoubtedly occur. But the trends are clear: more people than ever before in history will be competing for scarcer and scarcer resources in poorly governed areas that lack adequate infrastructure, and these areas will be more and more

¹⁹⁵ Liotta and Miskel, “Megacities: The Past, Present and Predictions for the Future.”

¹⁹⁶ In 1990, Christian missionary strategist Luis Bush coined the term “10/40 Window.” It refers to the regions of the eastern hemisphere, plus the European and African part of the western hemisphere, located between 10 and 40 degrees north of the equator. The 10/40 Window is home to the majority of the world’s poor, including 8 of 10 of the poorest poor. See “What is the 10/40 Window?” *Joshua Project*, accessed 17 March 2015, http://joshuaproject.net/resources/articles/10_40_window.

¹⁹⁷ U.S. Marine Corps, Deputy Commandant for Combat Development and Integration, “POM-17 Marine Corps Enterprise Integration Plan (MCEIP)” (report, U.S. Marine Corps, 2015), 7 and 61-62.

closely connected to the global system so that local conflict will have far wider effects.¹⁹⁸

Summary

To gain insights on the future security environment—and lay a foundation for examining possible alternative futures—this chapter surveyed and analyzed the principal patterns and trends in the areas of demographics, technology, resource competition, environmental stress, globalization, governance, and the urban littorals. Discussion of each category began with an assessment of the current state, proceeded to review the patterns and trends deemed most relevant to the future security environment, and ended by highlighting several implications for the future security environment and/or the U.S. role in this environment. Given the uncertainty inherent in forecasting and the complexity of the global system, this process necessarily requires a blend of expertise, judgment, and even some intuition. And it is clearly not possible to know with certainty today whether or not the process has produced a right “answer.”

Identifying and analyzing patterns and trends is, however, only a step in envisioning the future security environment. It is an important step because, to paraphrase Silvia Porter, today’s patterns and trends are drawing the future’s outlines, though not in a strictly deterministic sense. Some trends will evolve in a new direction, wildcards may cause a radical course change, and human activity can reshape events in unpredictable ways. Given the potential impact of numerous variables, prudent planners must contemplate an array of possible futures. Chapters 4 through 6 will address this task. However, the next chapter will first explore what the patterns and trends analyzed in chapter 2 portend for the “character of future conflict.”

¹⁹⁸ David Kilcullen, *Out of the Mountains: The Coming Age of the Urban Guerrilla* (New York: Oxford University Press, 2013), 50.

Chapter 3

The Character of Future Conflict

“War is not violence and killing, pure and simple; war is controlled violence, for a purpose. The purpose of war is to support your government’s decisions by force. The purpose is never to kill the enemy just to be killing him...but to make him do what you want him to do. Not killing...but controlled and purposeful violence.”

— Robert A. Heinlein, *Starship Troopers*

Overview

Future conflict will be characterized by increased reliance on technology to reduce costs and limit the need for “boots on the ground.” Significant segments of developed Western society increasingly view the use of force as transgressing moral, legal, and ethical boundaries. Consequently, the use of force will be seen as largely avoidable, as a failure of international cooperation,¹⁹⁹ and as a tool of last resort. Global proliferation of technology-enabled precision systems will also provide the means for more selective application of military power, yet in the hands of both state and non-state actors it carries the potential for wide scale disruption and destruction. The same technology trend will enable ever-higher echelons of command to more directly influence and manage actions in the field, while also enabling a broader societal sense of detachment from combat operations. Finally, conflicts will grow in complexity and intractability, blurring distinctions between victory and defeat, winners and losers, and possibly even redefining the idea of conflict itself.

Increased Reliance on Technology

The West²⁰⁰ generally, and the U.S. in particular, will continue to substitute technology for labor and soft power for hard power. Military spending in the West will continue to face downward pressure, mostly so that nations can sustain social spending in fiscally constrained times. Demographically the West is aging at the same time its economic regenerative powers decline,²⁰¹ forcing the social choice

¹⁹⁹ Michael Mandelbaum, “How War Made the State and the State Made Peace,” *Foreign Affairs* 93, no. 6 (2014): 154-158.

²⁰⁰ The exact scope of the Western world is somewhat subjective in nature, depending on the cultural, economic, spiritual, or political context. In this document, “the West” generally refers to the collection of nations that share certain fundamental political ideologies, including those of liberal democracy, the rule of law, and inalienable human rights.

²⁰¹ For a discussion of relevant demographic trends, see “Demographics” in chapter 2. For an additional discussion of long-term implications of demographic trends, see Nicholas Eberstadt, “The Demographic Future: What Population Growth—and Decline—Means for the Global Economy,” *Foreign Affairs* 89, no. 6 (2010): 54-64. To see a graphic portrayal of aging

(note continued)

between “guns or butter.” Since labor is expensive over the longer term, a partial solution will likely be to reduce manning levels and attempt to replace the same capability with machines—more specifically robotics—at first with semi-autonomous and eventually autonomous capabilities. Stiff competition in the economic marketplace for the types of recruits needed in the 21st century will raise the cost of skilled labor and expertise relative to alternatives to unsupportable levels in a shrinking pool of possible recruits.²⁰²

Military forces in the West will be smaller in terms of personnel strength, but will have greater capability and possibly increased capacity if the commitment to replace people with machines is resolute. Reinforcing the enduring commitment to technology is the general Western aversion to casualties. With this trend continuing into the future, militaries will endeavor not only to “take the man out of the minefield,” but also to take the “man off the battlefield.” To compensate for reduced numbers of personnel and equipment, to minimize casualties and collateral damage of all sorts, to increase tactical and operational opportunity, and to negate the requirement “to shoot back,”²⁰³ Western militaries, despite growing arguments about the ethics of battlefield robotics, will increasingly populate their forces with robotic capability. Capitalizing on technological proliferation, adversaries, both state and non-state, will likewise exploit robotic capability on the battlefield.

Technology provides the opportunity for greater precision. Advanced militaries will engage targets from increased standoff distances, thereby reducing the risk to friendly forces and lending credence to the argument that a multi-thousand dollar precision-guided munition is worth expending on a single terrorist. However, increased precision will beget heightened expectations, and an increasingly informed global population will demand a more frequent, detailed, and rapid accounting for each tactical mistake in the crowded conflict environment of the future.²⁰⁴ Nor will collateral damage or unnecessary casualties play well in an increasingly restrained legal, ethical, and moral atmosphere in which conflict occurs.²⁰⁵ Moreover, civilian casualties, collateral damage, and similar miscalculations, regardless of motive or intent, will provide ample ammunition for adversaries in the increasingly important area of “information” in conflict.²⁰⁶

population trends in the U.S. out to 2060, refer to U.S. Census Bureau projections for the U.S. population at <http://www.census.gov/population/projections/data/national/2014/summarytables.html>, in particular table 5.

²⁰² Brian Bowling, “As Wars End, Military Cuts Enlistment Goals,” *Military.com*, 17 June 2014, <http://www.military.com/daily-news/2014/06/17/as-wars-end-military-cuts-enlistment-goals.html>. The article concludes: “Another problem keeping out many Navy applicants is their performance on the Armed Services Vocational Aptitude Battery, the recruiters said. Many applicants don’t score high enough on reading comprehension, Smith said. ‘Everything we do is instruction, so you have to be able to comprehend things,’ he said.”

²⁰³ For a concise discussion, see Paul Scharre, *Robotics on the Battlefield Part II: The Coming Swarm* (Washington, DC: Center for a New American Security, 2014), 5-7.

²⁰⁴ The pros and cons of using unmanned aviation systems unfolded in two opposing articles in *Foreign Affairs*: see Daniel Byman, “Why Drones Work: The Case for Washington’s Weapon of Choice,” *Foreign Affairs* 92, no. 4 (2013):32-43 and Audrey Kurth Cronin, “Why Drones Fail: When Tactics Drive Strategy,” *Foreign Affairs* 92, no. 4 (2013): 44-54.

²⁰⁵ Linda Robinson et al., *Improving Strategic Competence: Lessons From 13 Years of War* (Santa Monica, CA: RAND Corporation, 2014), 2 and Cronin, “Why Drones Fail: When Tactics Drive Strategy,” 44-54.

²⁰⁶ David Kilcullen and Andrew McDonald, “Death From Above, and Outrage Down Below,” *The New York Times*, 17 May 2009, <http://nytimes.com/2009/05/17/opinion/17exum.html>.

Military spending will remain a highly contested part of the social-good debate at the same time as widely available commercial-off-the-shelf technologies proliferate in the modern conflict arena. Encumbered by highly structured procurement processes, conventional militaries²⁰⁷ in both the West and East will find it hard to compete over the coming decades with adversaries that are more agile. Indeed, conventional militaries may find themselves institutionally lagging in a new 21st century arms race. Consequent to the decreasing technology gap, adversaries will realize they only have to obtain a fraction of the capabilities associated with conventional major end items in order to accrue advantage. As a result, the conceptual precedence of the improvised explosive device (IED), a weapon costing a few dollars yet able to destroy vehicles costing tens of thousands, will carry long into the 21st century. While advanced militaries supported by robust national treasuries will continue their tendency to develop and procure complex, advanced, and expensive weaponry, adversaries will procure both offensive and defensive capabilities in all domains for a fraction of the costs imposed on these advanced forces. Additionally, the already closing technological gap will narrow further as technology proliferation and innovation in the lower-cost commercial sector bleeds and blends into military use, making technology insertion more affordable for lesser players and technological advantage even more fleeting for the major powers.

Military forces in the West will be smaller in terms of personnel strength, but will have greater capability and possibly increased capacity if the commitment to replace people with machines is resolute.

By 2050, greater than two-thirds of the world's population will live in the urban environment,²⁰⁸ where it will be difficult to distinguish friend from foe and innocent bystander or erstwhile neutral from adversary. Opponents will operate in the urban terrain in a manner that attempts to neutralize their enemies' technological capabilities. Operations in the urban environment will complicate targeting primarily from fear of inflicting civilian casualties or damaging symbolically sensitive infrastructure. Complications will also arise because the urban environment favors the defender, imparting a physical advantage in a multidimensional battlespace, which includes air, surface, supersurface, and subsurface components, along with interior and exterior spaces, and which is not easily penetrated or handled by conventional forces.²⁰⁹ Evidence indicates that urban operations are manpower intensive and casualty prone, exacting a physical and emotional toll that surpasses many other types of combat operations.²¹⁰ Pursuing an edge,

²⁰⁷ The terms "conventional militaries" or "conventional forces" used here describe the armed forces, normally of a nation-state, that are organized, trained, and equipped for conventional warfare—a form of warfare conducted using conventional weapons and tactics.

²⁰⁸ For a discussion of these estimates, including their sources, see "Demographics" and "Urban Littorals" in chapter 2.

²⁰⁹ Louis A. DiMarco, *Concrete Hell: Urban Warfare From Stalingrad to Iraq* (Oxford: Osprey Publishing, 2012), 28.

²¹⁰ See, in its entirety, William G. Robertson and Lawrence A. Yates, eds., *Block by Block: The Challenges of Urban Operations* (Fort Leavenworth, KS: U.S. Army Command and General Staff College Press, 2003) and, in particular, Lieutenant Colonel Lou DiMarco, "Attacking the Heart and Guts: Urban Operations Through the Ages," in *Block by Block: The Challenges of Urban Operations*, eds. William G. Robertson and Lawrence A. Yates (Fort Leavenworth, KS: U.S. Army

(note continued)

adversaries will “hug” the civilian community, staying close to the population, to buildings of religious or historical significance, and to legitimate authorities who provide a stabilizing force. Distinguishing between combatants and non-combatants will be even more difficult than before in the multidimensional future urban environment.

Tempted by the reduced risk at the tactical level associated with the use of high-technology precision weapons, developed nations with advanced militaries, particularly in the West, will attempt to forego “boots on the ground,” preferring engagement at distance.²¹¹ This alone will lead to increased operational and strategic risk, where tactics end up driving strategy.²¹² Furthermore, greater reliance on unmanned systems may actually increase the likelihood of conflict,²¹³ since presumably there would be fewer evocative images of human suffering. Nevertheless, the prevailing understanding is that the application of hard, largely kinetic power may be a necessary but still insufficient condition on its own for success in the vast majority of conflicts.²¹⁴ From a conventional force’s perspective, and with unconventional warfare concepts gaining traction, the use of proxies supported with high-tech precision weapons is likely to be increasingly preferable and viewed as less risky. Increasingly, the West will eschew, as far as politically possible, conflicts that require personnel on the ground, as it did in the Rwandan Civil War (1990-1994), and as occurred in the Libyan Civil War, the most recent conflicts in Syria and Iraq, and the crisis in Yemen.²¹⁵

Reduced Utility of Force

Because of growing distaste for the use of kinetically delivered military power, policy makers will increasingly favor non-kinetic capabilities and a “whole-of-government,” even a “whole-of-society,” approach to conflict resolution. The legitimacy of military force is more widely challenged in the West, and some no longer accept at face value the idea of “war as politics by other means.” At the same time, information operations and strategic communication as part of a whole-of-government approach will grow in importance. Unable or unwilling to employ traditional kinetic systems in newly crowded and congested battlespace domains where force-on-force confrontations diminish in frequency and utility, conventional forces may self-restrict their engagements under ever-tightening rules of engagement in a manner that paradoxically offsets or reduces the U.S. and Western technological edge.

Command and General Staff College Press, 2003), 1-28. See also U.S. Department of Defense, *Joint Urban Operations*, I-2 to I-9.

²¹¹ “One of the greatest realizations of human power is the ability to destroy at a distance....” Reginald Victor Jones, *The Wizard War: British Scientific Intelligence, 1939-1945* (New York: Coward, McCann & Geoghegan, 1978), 455. See also Byman, “Why Drones Work,” 32-43.

²¹² Cronin, “Why Drones Fail,” 44-54.

²¹³ P.W. Singer, “Robots at War: The New Battlefield,” in *The Changing Character of War*, eds. Hew Strachan and Sibylle Scheippers (Oxford: Oxford University Press, 2011), 346-347.

²¹⁴ Richard K. Betts, “Pick Your Battles: Ending America’s Era of Permanent War,” *Foreign Affairs* 93, no. 6 (2014): 15-24.

²¹⁵ Liam Bamford, “Other People’s Boots,” *American Thinker*, last modified 5 November 2014,

http://www.americanthinker.com/articles/2014/11/other_peoples_boots.html.

Among populations, the “key terrain” will be the people—the committed, the uncommitted, and the indeterminate—not the ground. The reality is that perceptions may matter more than facts. How one views unnecessary casualties or collateral damage will often be in the eye of the individual beholder. Individuals, either as a part of or apart from state and non-state actors, acting even in a mercenary fashion, will be empowered by an ever-growing ability to tap social media networks. Consequently, they will wield an ability to influence audiences out of all proportion to their physical numbers. Agile adversaries, unencumbered by bureaucratic and legal procedure, hierarchical process, and legacy rules, will place conventional forces at a disadvantage in the information operations (IO) arena if they have not improved their IO capability and agility in the preceding years. Moreover, the rallying power of “information connectedness” seems to be a mostly negative force because it can organize protest but it appears less effective at organizing governance that is more enduring or catalyzing a return to order. In the longer term, strategic communication empowered by enduring values, the unbiased application of the rule of law, organizational and institutional structures, and the conduct of HA/DR operations may provide a more durable and exploitable advantage to the conventional nation-state.

Less Destruction, Fewer Casualties

Over time, wars have become far less destructive affairs as the community of nations has had recourse to a wider array of non-military alternatives to help reduce or avoid conflict. Many of these measures were not in place before World War II. There was, for instance, a tacit agreement among superpowers to regulate the scope of power politics. There was not almost universal access to information as there is now.²¹⁶ Access to information and coverage of events will increase further over time. Thanks to the ubiquity of communication now and in the future, any conflict takes on almost instant global significance. This same pervasiveness, however, tends to skew perceptions of the prevalence of conflict.²¹⁷ Interstate wars, the most destructive of all conflicts, have declined in frequency and even the most recently destructive today cannot match the sanguinity of 20th century wars.²¹⁸ Additionally, all state and non-state actors, friendly or otherwise, have taken to heart lessons learned about engaging developed nations with advanced militaries in conventional terms. Conflicts in post-invasion Iraq and Afghanistan revealed the efficacy of fighting conventional military

²¹⁶ Adam Taylor, “200,000 dead? Why Syria’s rising death toll is so divisive,” *The Washington Post*, 3 December 2014, <http://www.washingtonpost.com/blogs/worldviews/wp/2014/12/03/200000-dead-why-syrias-rising-death-toll-is-so-divisive/>.

²¹⁷ Defining war is difficult and controversial. The Correlates of War project uses 1,000 battle deaths within a 12-month period as a measure of “sustained combat.” For an overview of relevant definitions, descriptions, and variables, see Meredith Reid Sarkees, “The COW Typology of War: Defining and Categorizing Wars (Version 4 of the Data),” accessed 18 March 2015, http://cow.la.psu.edu/COW2%20Data/WarData_NEW/COW%20Website%20-%20Typology%20of%20war.pdf. For an earlier more detailed discussion, see chapter 2 of Meredith Reid Sarkees and Frank Whelon Wayman, *Resort to War: A Data Guide to Inter-State, Extra-State, Intra-State, and Non-State Wars, 1816-2007* (Washington, DC: CQ Press, 2010).

²¹⁸ Joshua S. Goldstein and Steven Pinker, “War Really is Going Out of Style,” *New York Times*, 17 December 2011, http://www.nytimes.com/2011/12/18/opinion/sunday/war-really-is-going-out-of-style.html?_r=0.

forces using “irregular warfare”²¹⁹ techniques with an emphasis on information operations.²²⁰ In cases of intrastate conflicts like insurgencies or civil wars, casualties are fewer in number even if they are, for the participants, just as intense and possibly more vicious on a personal level.

Worldwide, the annual rate of battle deaths dropped from 300 per 100,000 people during World War II to 30 per 100,000 during the Korean conflict, and it fell into the low teens during the Vietnam War. By the 21st century, only 1 in 100,000 was killed in combat.²²¹ Over the course of the more than 10 years of conflict in Iraq and Afghanistan, the U.S. suffered fewer than 7,000 fatalities, compared to nearly 60,000 in Vietnam over a similar time span. Besides increased battlefield competence as a result of the transition to an all-volunteer force, this may indicate an increased emphasis on force protection reflecting the public’s concerns regarding casualties suffered in non-existential conflicts. This deep-seated concern for service members’ well-being will likely increase.

The growing reliance on precision weapons facilitates the mitigation of casualties and collateral damage, which also reduces the size and quantity of ordnance required to destroy targets or inflict casualties. Moreover, the general reluctance on the part of nations that are most militarily capable to use force except as a measure of last resort has led to conflicts that are less bloody and destructive. While intrastate conflicts may be vicious, the belligerents typically lack the capabilities

for greater death and destruction unless externally supplied. When prosecuted by developed nations, wars, if armed conflicts even attain that status, will therefore become “quicker” affairs that are difficult to sustain politically and militarily. Nations so engaged will be aware that the window of opportunity for combat operations is small and that the adversaries they fight will know that extending armed conflict, even with a relative dribble of casualties,²²² causes high-pressure dissent.²²³ Conceivably then, there could be greater emphasis placed on the concept of the punitive raid, in which punishing adversaries makes “attributable acts an attribute.”²²⁴ But, on some level this may also indicate a broader acceptance that, while some forms of crisis response may

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²¹⁹ There is an undercurrent of thought that irregular war, given its historical frequency, is the norm and should be called “regular,” while conventional state-versus-state conflict, rare and getting rarer, should be called “irregular.”

²²⁰ David Seed, ed., *Future Wars: The Anticipation and the Fears* (Liverpool: Liverpool University Press, 2012), 252. To illustrate the point, Antulio J. Eschevarria, in his contribution to the collection, quotes from page 252 of Conrad Crane’s unpublished piece “Heresies and Hand Grenades: Observations on the Long War”: “There are two ways of fighting: fighting asymmetrically, and fighting stupid.”

²²¹ Goldstein and Pinker, “War Really is Going Out of Style.”

²²² To some extent the aphorism that an irregular force can “win by not losing” may have changed even more drastically to “an irregular force can win while losing” since battlefield tactical successes seem to have fewer operational and strategic consequences in the so-called information age.

²²³ DiMarco, *Concrete Hell*, 178.

²²⁴ Deliberations at the Futures Assessment Division’s “Character of Future Conflict” Roundtable and Workshop, Quantico, VA, March 31, 2015. Lawrence Korb is credited with a similar assessment in P.W. Singer, “Robots at War,” 346-347.

have merit, the ability to prevent crisis, something that is hard to prove, has less efficacy in the future.

The human toll of conflict will continue to be a major factor in warfare, influencing the actions and decisions of all parties. Gruesome images of death and destruction, while mortifying to all civilized observers, often still carry much political value that other state and non-state actors are able to harvest, suggesting this dynamic is likely to continue well into the future. Combat amidst the ruins of Grozny, for example, drew much unwanted attention upon the Russians from the international community. Fighting in the urban sprawl of the Gaza strip and the West Bank, specifically Jenin in 2002, weighed heavily on the Israelis²²⁵ just as it had when they helped rubble Beirut. Urban fighting in Syria, and to a lesser degree in Iraq, evoked and evokes powerful images and permits adversaries to capitalize on the international community's sense of outrage, ultimately short-circuiting and derailing strategic plans. The U.S. experience in Fallujah and Ramadi serve as cautionary notes for policy makers. Combat in the urban environment invariably equates to the need for lengthy operations with large forces and presupposes heavy casualties and great destruction.²²⁶ Together, these well-founded concerns will incline policy makers to avoid committing conventional forces to the urban environment, while these same conditions will encourage adversaries to exploit this same dimension and tension.

Despite these phenomena, battlefield casualties have declined markedly as a function of the decline of interstate conflict. Ostensibly, the Syrian civil war seems to refute this observation, with the Syrian Observatory for Human Rights estimating that over 200,000 people have been killed during the conflict in just 3 years.²²⁷ As terrible as this number is, and it may underestimate the human toll, even this iconic symbol of current internecine warfare does not measure up to the catastrophe of the conflicts in Korea and Vietnam.

While worldwide media coverage evokes a sense of pervasive and increasing violence around the world, evidence indicates a general trend of declining violence from conflict. The reasons for the change will be, as always, subject to the vicissitudes and vagaries of policy makers, luck, and miscalculation,²²⁸ but there is hope the trend will continue over the long term.²²⁹ For the most part, nation-states have found other ways to resolve their differences, understanding that the

²²⁵ DiMarco, *Concrete Hell*, 151-188. Grozny and Jenin were eventual tactical and operational successes, but strategically costly operations, primarily because the Russians and Israelis were challenged in the information spectrum.

²²⁶ There is some evidence that this need not always be the case. In his book *Concrete Hell*, DiMarco draws a contrast between the Marine Corps' taking of Fallujah in Operation Phantom Fury (2004) and the Army's retaking of Ramadi in 2006-2007. The Marine Corps seized Fallujah from the city's outskirts, while the Army recaptured Ramadi from within. The former operation employed thousands of men and cost hundreds of casualties, while the latter was accomplished much less bloodily with a brigade combat team. Moreover, to retake Fallujah the Marines, in words David Kilcullen used to describe a similar incident, "killed the city" (Kilcullen, *Out of the Mountains*, 18), while Ramadi, a city two and a half times larger than Fallujah, suffered little damage. In fact, the 1st BCT's success was so profound, few know of it.

²²⁷ Taylor, "200,000 dead? Why Syria's rising death toll is so divisive."

²²⁸ Lawrence Freedman, "Stephen Pinker and the Long Peace: Alliance, Deterrence, and Decline," *Cold War History* 14, no. 4 (2014): 657-672.

²²⁹ Goldstein and Pinker, "War Really is Going Out of Style."

consequences of armed conflict between nation-states are truly dire. Non-state actors, absent the ability to use weapons of mass destruction (at least for now) lack the long-term endurance to conduct sustained warfare at high intensity. Instead, neither able nor desiring to match conventional firepower, state and non-state actors will rely more on the power of words, images, and money to influence the international community, while also engaging in various forms of low intensity conflict, terrorism, and criminal violence. Information operations will rise in prominence, as evident in conflagrations in Grozny, Jenin, Libya, Egypt, and Syria.²³⁰ Unencumbered by bureaucracy or the need to satisfy the demands of pluralistic liberal society, antagonists will exploit information with far greater agility than developed Western-style nation-states. These independent operations can connect directly to the human element, both near and far, without having to rely on accuracy or facts.²³¹ Raw information operations will appeal at a primordial level by exploiting mistakes (usually targeting errors), assigning blame, and taking liberties in the gray areas among truth, doubt, and myth. They can wage a propaganda war on terms far more favorable to them than to conventional militaries or governments. However, nation-states will exploit the longer-term power of strategic communications based on concrete accomplishments rather than the short-term power of vitriol and blandishments.

The view that conflict is in decline, however, is far from universal, with credible dissenters warning of the dire consequences of ignoring history's lessons and suggesting that strategically the most dangerous inflection point or points are yet to come. Thus, the "Long Peace," as some have called the period after the end of World War II, may have been an anomaly, the result of a Cold War that if it had turned "hot" would have had consequences too terrible to conceive. The moderating effect of a possible humanity-ending catastrophe was considerable, forcing the superpowers to consider seriously their actions and the actions of their allies and proxies before embarking on a path to superpower conflict. That inclination toward caution among near-equals, in full understanding of the second- and third-order effects of their actions, together with the gravitas and authority that comes with being great powers, no longer stands.²³² Instead, the potential proliferation of weapons of mass destruction threatens to disturb that balance, empowering actors who appear to care little for post-Cold War equilibrium, the niceties of convention, legacy standards of conduct, or the current international order.

Nor does history suggest that the nexus of one hegemon's decline and the rise of another will occur easily. The most dangerous strategic moments may well occur when a near-peer ascends to intersect at the point of decline of another, foreshadowing perhaps periods of increased tension, confrontation, and decision missteps. Moreover, there is little historical precedent for a country or state to attack another because it was too strong, which lends credence to the counterintuitive idea that states most prepared for war are best at maintaining peace. Current trends in Western defense

²³⁰ DiMarco, *Concrete Hell*, 184-185.

²³¹ Ibid. See also the section titled "The Massacre and Information Operations."

²³² Freedman, "Stephen Pinker and the Long Peace," 657-672.

spending therefore may be a harbinger of heightened, not diminished, tensions. Through the lens of high-intensity conflict prosecuted between global powers, analysis raises the possibility that the world is a less dangerous place and is likely to remain so, but that looking forward the potential for cataclysmic disaster is far from beyond the realm of possibility because of technology proliferation and political miscalculation.²³³

Conflict: More Detached and Indirect

Diffuse viewpoints, growing numbers of segmented constituencies, information-enabled and empowered citizenry,²³⁴ and fractured alliances, coalitions, and partnerships will make the search for common ground and consensus for action difficult. Moreover, these efforts necessarily reduce objectives to the uncontentious least common denominator among parties whose own interests transcend those of the wider community. Technology-enabled precision affords decision makers the means to engage adversaries at distance, divorced to an extent from the difficulties that accompany forming alliances and compromising objectives, all while remaining largely beyond the scrutiny of the wider public. Technological warfare using unmanned systems allows protagonists to engage high-value targets below the “radar horizon” of the public’s concern and allows partners to plausibly disavow acts, decrying them as incursions or unauthorized strikes.²³⁵ Warfare at that level is more detached and distant, and it rarely concerns the majority of citizens to a level that would generate their interest, much less their intercession. Engagement by conventional forces requiring the deployment of troops for combat operations will be rarer, replaced instead by high-technology weapons systems; intelligence, surveillance, and reconnaissance (ISR); command and control (C2); and training, advising, and assistance missions in support of challenged partners.²³⁶ Nations will use the blunt instrument of military power conservatively, avoiding where possible the considerable and occasionally onerous task of persuading the legislature, the people, and the international community of the need for military action. Detached conflict at a distance in support of state and non-state proxies in the most likely conflicts will become increasingly prevalent, absent a clear existential threat.

Because of this trend towards technology substitution and the detachment it affords, future conflict will erode the traditional concept of the need for a “man in the loop.” Information technology and C2 systems in the future will link the commander to the operator to such an extent that traditional hierarchical echelons of command will be obsolescent, and the operators will

²³³ General Martin E. Dempsey, foreword to *Capstone Concept for Joint Operations: Joint Force 2020*, in U.S. Department of Defense, Joint Chiefs of Staff (Washington, DC: U.S. Department of Defense, 2012), iii. General Dempsey observes: “While the world is trending toward greater stability overall, destructive technologies are available to a wider and more disparate range of adversaries. As a result the world is potentially more dangerous than ever before.”

²³⁴ For insights on the difficulty on gaining consensus in pluralistic society, see Horst W.J. Rittel and Melvin M. Webber, “Dilemmas in a General Theory of Planning,” *Policy Sciences* 4, no. 2 (1973): 167-169.

²³⁵ Unmanned system strikes launched from Pakistan into Afghanistan or the Free Tribal Areas or from the Horn of Africa, or even from the U.S. illustrate the point.

²³⁶ Current operations in Iraq may serve as a model for future military engagement by advanced militaries.

become more dispersed. Lacing the potential of improved C2 systems with the decision authorities assigned to commanders will determine the extent to which conventional forces will operate in this fashion during future crises. In most situations, critics will cast this technology-enabled C2 and its consequences as “micro-management.” In fact, it merely reflects what some view as the logical application of technology to the C2 challenge, enabling the replacement of layered bureaucracy and the dispersal of forces, as well as enhancing speed of execution.

As a result of technology-enhanced detachment, there will be increased likelihood of a “Second Cold War,” a different form of detachment, where first-tier nations do not engage each other directly but rely on proxies, both state and non-state, to help achieve their ends or thwart those of their adversaries. Justifying reprisals remains difficult without attribution and the pursuit of consensus dilutes action even in the face of the most convincing evidence of culpability.²³⁷ State against state conflict, rarer in the future anyway, will become the remit of an increasingly smaller, more specialized, more select group of people in both the conventional and unconventional sense. Additionally, the actions during conflict by this more select group will be facilitated by increasing numbers of technology-enabled technocrats, often indistinguishable from everyday citizens, thereby complicating targeting of these facilitators through conventional means.

Why There Will Be Increased Complexity

Circumstances in the future will redefine “victory” and “defeat,” “success” and “failure”; deciphering winners from losers will be increasingly problematic. National and international leaders will find it difficult to create unity among allies, friends, and partners as the constituents pursue their own agendas. Often these separate group agendas will clash, as state and non-state actors seek to advance their interests. Globalization will add complexity as non-state actors act in concert with like-minded partners around the globe, potentially placing them in opposition to authorities within their own nations. International trade objectives and internal political dynamics may divert and water down coalition goals. Assistance will often seem like resistance. Adversaries will target constituent partners through information technology to foment dissent and apathy, and economic weaknesses will be targeted to threaten or create hardship. Domestically, garnering consensus, particularly within liberal democratic states, will be difficult since information technology disproportionately empowers what would otherwise be marginal groups.

Conflicts will be harder to resolve. Victory will be elusive, success harder to define. Conflict through proxies and hybrids will make immediate attribution difficult, although advanced technological capabilities may enable eventual identification of the true aggressors. Although belligerents may more easily achieve “plausible deniability” in the future, some proxies will embrace responsibility for atrocious acts to raise their profiles so that signature attacks may become even

²³⁷ Witness the North Korean sinking of the Republic of Korea Ship *Cheonan*, Iran’s support to Hezbollah, Russia’s support to anti-Ukrainian separatists, and Pakistan’s support to anti-U.S. and anti-Indian forces.

more atrocious. Increased ability to avoid responsibility, together with diffused leadership and difficulties in attributing aggressor actions, will provide adversaries windows of opportunity to pursue nuclear, biological, and chemical weapons as backstops to their rogue behavior. This, in turn, will lead to even greater reluctance of first-tier states to engage adversaries, cognizant as they will be of inviting reprisal.²³⁸

Traditionally impatient, the West in general, and the American people specifically, demand quick success in comparison to others who take a longer view. This Western expectation already stands in contradiction with the character of modern conflict, which, less frequent and less intense, demands a generational approach that bedevils orthodox liberal political systems. Nor will future conflict short of war lend itself to quick resolution as non-state actors in particular seek an advantage in protracting the conflict. Furthermore, history reinforces the sense that, once conventional nation-state forces are engaged in a conflict, metrics to justify terminating that commitment (based, for example, on definitions of success or mission accomplishment) are hard to define.²³⁹

As in the past, future conflict will take place among the people, not apart from them, but it will be even more challenging as the belligerents in any given conflict multiply in number and variety. Adversaries will not necessarily distinguish themselves with uniforms, instead blending with the population. Cultural differences will confuse orthodox forces that will face groups that are at once friend, foe, neutral, and undefined. Future adversaries will not feel compelled to, nor will they abide by, nation-state conventions regarding the conduct of conflict. They will perform outrageous acts—to the eyes of civilized sensibilities—and seek to provoke overreactions and backlash for propaganda value. Moreover, globalization will bring together a convergence of seemingly disparate and hitherto disconnected parties that will facilitate terrorism, insurgency, and rogue-state actions through corruption, smuggling, money laundering, cyber mischief, and other means normally considered criminal activities but now conducted in support of various causes.

More than in the past, future non-state actors, hybrids, and proxies will be able to split into varying factions, making it difficult to identify who is in control. Additionally, the splintering of groups may make satisfying an adversary's demands [via negotiation] impossible.

²³⁸ Thom Shanker, "Mapping Military Needs, Aided by a Big Projection," *The New York Times*, 11 September 2012, http://www.nytimes.com/2012/09/12/us/top-general-dempsey-maps-out-us-military-future.html?_r=0. Comments by General Martine E. Dempsey, Chairman of the Joint Chiefs of Staff: "In the future, our homeland will not be the sanctuary it has been." The article goes on to summarize planners' thoughts that "...American territory most likely would be attacked as part of an adversary's actions, regardless of where the major fighting was focused overseas. That attack might be direct, by missile, or more asymmetrical, as in terrorism or via a computer-network cyberattack." The 2004 Madrid train bombings by Al Qaeda highlight the quandary that allies face when singled out by non-state groups with global reach.

²³⁹ James F. Jeffrey, "Why Counterinsurgency Doesn't Work: The Problem is the Strategy, Not the Execution," *Foreign Affairs* 94, no. 2 (2015): 178-180.

Convergence then will necessitate engaging future antagonists on a number of levels beyond the merely military. Engagement will call for much improved interaction with the population, a population that will include adversaries, as well as the undecided, neutrals, and friendlies. Missions that are outwardly HA/DR operations will contain the potential to escalate rapidly into varying degrees of combat. Conflict, kinetic or otherwise, among the people will create and exacerbate refugee problems and complicate even the most benign or benevolent missions as adversaries seek advantage in others' suffering. Refugee diasporas will influence operations far removed from what will be seen as the primary scene of action.

These same displaced refugee populations, besides stressing the social welfare capacities of the urban centers, regions, and countries to which they flee, will bring with them and concentrate further the religious, ethnic, and tribal stressors that caused them to flee in the first place. At the same time, an array of actors will pressure developed nations to act altruistically in situations and crises that have scant links to traditional national interests.²⁴⁰ The "responsibility to protect" may even supersede the increasingly established concept of the "responsibility to assist."²⁴¹ Many of the most troubled regions will be alternatively governed—governed in ways that might be anathema to orthodoxy, but governed nonetheless. Decision makers must understand that there are no political vacuums to fill, only political frameworks to use, displace, or even replace. Working in such environments will be much more complex than in the past, requiring collaboration with second and third parties whose motivations are seen as opaque, ulterior, and even abstract to conventional thinking.

More than in the past, future non-state actors, hybrids, and proxies will be able to split into varying factions, making it difficult to identify who is in control. Additionally, the splintering of groups may make satisfying an adversary's demands impossible, as each breakaway subgroup claims to be the true adherent to the cause, faith, or objective and demonstrates its faithfulness to the cause by the extremity of its demands, actions, and willingness to continue the struggle. Negotiating with such organizations will require very high levels of political savvy, substantial flexibility, and a nuanced approach to long-term conciliation and forgiveness for previous acts that were once

²⁴⁰ Paul Salopek, "What Happens When You Become a War Refugee?" *National Geographic*, March 2015, 56-71. According to the article, there are 1.6 million Syrian war refugees in Turkey with another 8 million internally displaced. Up to 12 million people may be displaced across the Middle East as a result of the war. The United Nations states that there are approximately "43 million uprooted victims of conflict and persecution worldwide. More than 15 million of them are refugees who have fled their countries, while another 27 million are people who remain displaced by conflict inside their own homelands." See "Refugees: Overview of Forced Displacement," *United Nations: Resources for Speakers on Global Issues*, accessed 25 February 2015, <http://www.un.org/en/globalissues/briefingpapers/refugees/overviewofforceddisplacement.html>.

²⁴¹ The notion of a "responsibility to protect" was borne of the international community's failure to respond effectively to tragedies during the 1990s (e.g., the Rwandan genocide in 1994 and the Srebrenica massacre in 1995). The emerging norm was perhaps first codified as a result of a Canadian government initiative during 2000-2001. See International Commission on Intervention and State Sovereignty, *The Responsibility to Protect: Report of the International Commission on Intervention and State Sovereignty* (Ottawa: International Development Research Centre, 2001).

considered acts of terrorism.²⁴² But, compromise will often be seen as weakness, especially when policy and decision makers trap themselves by their own rhetoric, affording themselves little maneuver space in light of subsequent events.²⁴³ On such occasions, there will be no room for the luxury of emotion in 21st century conflict settings; military operators will have to function with cool detachment at a level of cultural understanding, maturity, and restraint hardly contemplated even a few years ago.

Finally, the proliferation of technology, impact of globalization, and expansion of refugee diasporas mean that future conflict will be characterized by the end of safe havens. Anti-access and area denial (A2/AD) capabilities will no longer remain the exclusive domain of developed nations. Distinctions will also blur between anti-access and area denial capabilities as weapons extend their reach and functionality, able to deny both access and operational maneuver. In the future security environment, “away games” may no longer be truly “away”—at the very least, they will not be without consequence in the homeland. Nation-states will have to carefully consider overseas engagements and the ensuing ramifications of these actions that will bring terrorist, cyber,²⁴⁴ and space retaliation to their state.

Summary

This chapter offers a glimpse at the character of future conflict, based on observed and expected evolution in warfare’s means, methods, and “shapeshifting” participants. This does not suggest a change in the basic nature of war, which is timeless and unchanging—a “violent struggle between...hostile, independent, and irreconcilable wills, each trying to impose itself on the other.”²⁴⁵ War remains fundamentally an interactive political and social phenomenon. The character of conflict (or warfare, as distinct from war) does change, and it is “undoubtedly influenced by technology, law, ethics, culture, methods of social, political, and military organization, and other factors that change across time and place.”²⁴⁶ Present and future evolution and upheaval within

²⁴² One case in point is the struggle in Northern Ireland. The Irish Republican Army (IRA) splintered through the years into varying factions such as, but not limited to the Provisional IRA, The Real IRA, and the Irish National Liberation Army, each incrementally more extreme than the other. The same phenomenon occurred on the Unionist side with the Ulster Volunteer Force, the Ulster Defence Association, and the Red Hand Commandos. The final peace, if one can call it that yet, now includes numerous members of these former organizations on both sides of the government and an almost universal pardon of crimes, crimes that linger long in the memories of both sides.

²⁴³ The opening gambit of many decision makers for instance is to categorically state they will not negotiate with terrorists. From a conflict perspective, this inhibits resolution and invariably turns out to be wrong. For an examination of negotiation and game theory, see Thomas C. Schelling, *The Strategy of Conflict* (Cambridge, MA: Harvard University Press, 1980).

²⁴⁴ Interestingly, the cyber domain may be the first man-made domain. If that is the case, and the consequences of cyber breakdown are as bad as some believe, then it is conceivable that the U.S. could literally “be hoisted on its own petard.”

²⁴⁵ U.S. Marine Corps, *Warfighting* (MCDP 1) (Washington, DC: U.S. Government Printing Office, 1997), 3.

²⁴⁶ Christopher Mewett, “Understanding War’s Enduring Nature Alongside its Changing Character,” *War on the Rocks*, 21 January 2014, <http://warontherocks.com/2014/01/understanding-wars-enduring-nature-alongside-its-changing-character/>.

these domains reshapes the character of conflict. Survey and analysis of observable trends today suggests that future conflict will be characterized by:

- Increased reliance on technology, which will be more widely available to state and non-state actors alike;
- Reduced utility of force, as some will regard the legitimacy of military force with skepticism;
- Less destruction and fewer casualties, due in large measure to the decline in interstate conflict and the proliferation of precision weapons, which reduce collateral damage;
- Increased detachment, as technology increasingly displaces humans in warfare and the most powerful actors operate via proxies to prevent a conflict from escalating out of control; and,
- Increased complexity, resulting from, *inter alia*, the multiplicity of participant types (e.g., nation-states, non-state actors, hybrids, proxies, etc.), the simultaneity of conflict intensities in a single operation or region, and the difficulty of defining success or victory, let alone achieving a decisive outcome.

These are the main lessons drawn from this extrapolation of the changing character of conflict.

Examining the dominant patterns and trends already shaping the future and exploring the character of future conflict lay the foundation in the foresight process. The more creative and more fruitful portion of the forecasting effort involves the development and examination of various possible futures. The next chapter begins this next step in the process by projecting today's dominant patterns and trends, unaltered, into the future and then describing the result: the baseline future. Subsequent chapters will explore alternative futures, derived by plausibly altering carefully selected patterns and trends and projecting the results, and a preferred future, derived from the interaction and momentum of institutional strategies, policies, and culture.

Chapter 4

World in 5-D Multiplex: The Baseline Future

"A good forecaster is not smarter than everyone else, he merely has his ignorance better organized."

— Anonymous

Overview

Despite scientific and technological advancement, economic growth, and social development around the globe, the arc of instability (see figure 2-8) continues to suffer from a complex confluence of factors leading to local and regional political instability, social unrest, and conflict during the period 2030-2045. In the preceding decades, this area suffered more numerous and severe natural disasters and disease outbreaks, with the human toll exacerbated by the effects of human populations packed densely into urban agglomerations in the world's littoral regions.

The absolute number of people experiencing chronic food and water shortages has increased, despite the decline in the percentage of the world's population suffering from long-term shortages. Lacking substantial improvements in energy and water management and distribution, shortages of water and food continue to plague remote regions where hunger and lack of sanitation remain chronic problems. These challenges also intersect with large mobile populations, and significant migrations of people seeking relief further stress local and regional resources. The number and size of megacities continue to increase, although the pace of growth has slowed. By 2030, nearly two billion people reside in the peri-urban slums of the world's 41 megacities.²⁴⁷ They enjoy little security or economic opportunity, and their fragile governments are unable to consistently provide basic services (e.g., potable water, sanitation, and electricity). The migration of diverse populations to urban areas has created an array of complex, chaotic human systems that often seem immune to effective management or control. This poses a particular challenge in the realm of public health, as outbreaks of communicable disease often strain the resources and capacity of local governments to respond except in the most developed regions. These large and densely populated areas experience enormous destruction when natural disasters strike.

²⁴⁷ United Nations, *World Urbanization Prospects: The 2014 Revision*, 13-16.

Weak governance of the megacities and surrounding peri-urban slums has generated shadow governments: local gangs, crime syndicates, and terrorist organizations that provide a semblance of alternate governance, but exploit the population. These organizations employ highly connected networks that provide extensive access to information and influence over people. They make use of cheap and readily available state-of-the-art technologies such as 3-D printing, inexpensive precision location and targeting capabilities, cyber tools, biological and chemical weapons, and autonomous air, land, and sea vehicles. These entities and other non-state actors use these new technologies with increasing degrees of sophistication, ingenuity, and adaptability. They

have learned to employ tactics, such as massing and swarming unmanned systems, against which defense is difficult, and they exploit limited sight lines in the peri-urban or slum areas to conceal forces and maneuver unmolested.

In the multipolar world beyond 2030, the United States and its partners face near-peer state actors, as well as more sophisticated non-state actors empowered by the proliferation of technology and information.

Within the arc of instability, conflict occurs mostly among the populace in the complex urban environment, although adversaries also continue to exploit the relative operating security afforded by thick jungle and rugged terrain. Both state and non-state actors attempt to gain an information advantage by leveraging an unrelenting media cycle of news broadcasters, bloggers, pundits, preachers, politicians, and active observers to disseminate their messages, maneuver their forces, and manipulate their audiences. Here, adversaries are as likely to use a variety of high-end precision weapons and autonomous sensing

systems as they are to use relatively primitive improvised explosive devices and Molotov cocktails. The “Three Block War,” where combat, peacekeeping, and humanitarian assistance operations occur simultaneously on adjoining city blocks as anticipated by General Charles Krulak in 1999,²⁴⁸ evolved by 2030 into a “Three Floor War,” where the same actions occur simultaneously in one or more high-rise buildings within one block of a crowded urban littoral slum.

Key Attributes

Political

The global political atmosphere is often discordant. The information age continues to foster an environment of immediate, unmeasured, and often unfortunate initial responses to emerging political challenges and crises. In the United States, domestic political considerations continue to play a central role in foreign policy decision making. United States participation remains an essential ingredient of international action, but the U.S. body politic prefers to defer leadership during crises

²⁴⁸ Charles C. Krulak, “The Strategic Corporal: Leadership in the Three Block War,” *Marines Magazine* 28, no. 1 (1999): 29-32.

and conflicts to multilateral organizations like the UN, NATO, and Association of Southeast Asian Nations (ASEAN). The political, economic, and military power of other nations is rising relative to the West, including the United States. Of note, the increase in China's and India's shares of the world's gross domestic product, as well as their growing naval power, gives these nations greater influence on operations within the arc of instability. Multilateral decision making has become the norm for operations beyond pre-conflict shaping operations such as military engagement, security cooperation, and deterrence. Consequently, U.S. policy makers continue to face a variety of related challenges, including:

- Ill-defined missions and objectives;
- Complex—or even unclear—operational geometry;
- Constrained access to ports and airfields;
- Limitations on overflight rights;
- Complex rules of engagement;
- Complex command arrangements and command and control structure;
- Inadequacy of and/or limitations on use of the local infrastructure (e.g., communications, transportation, buildings, and energy);
- Limitations on use of the local resources (e.g., water, food, and fuel);
- Coordination of economic instruments of suasion and coercion, such as freezing adversary bank accounts and imposing sanctions, through slow, deliberative, consensus-based bodies;
- Limited inclination by the West to commit ground troops.

Intergovernmental organizations, nongovernmental organizations, and multinational corporations increasingly affect political decision making on a global scale. Many of these entities, including multinational corporations operating in rapidly growing fields (e.g., information technology and “green” industries), have expanded internationally and now wield substantial political influence. International criminal organizations, terrorist organizations, and radical movements, which once operated principally under the radar, rise to challenge nation-states with increasing frequency, and often assume governmental authorities and responsibilities in areas where traditional nation-state governance is diminished or has failed altogether.

Military

During the 2020s, Western governments continued to emphasize funding for social programs, while reducing military spending and manpower. Western militaries increasingly rely on unmanned systems to reduce personnel costs, sidestep “boots-on-the-ground” restrictions, and curb casualties. Globalization and proliferation have made relatively advanced and inexpensive technology, with both offensive and defensive applications, readily available to potential U.S. adversaries, including non-state actors. This includes robotic systems and other unmanned land, air, and sea platforms. Makers of improvised explosive devices (IEDs) are increasingly more adaptive, producing weapons that are more lethal and harder to detect.

Military operations are mostly multinational, not necessarily led by the United States, and more complex than ever. When conducting combat or stability operations, U.S. forces confront

collections of adversaries and neutrals that defy a simple blue force-red force dichotomy, and the demand for humanitarian assistance accompanies virtually every scenario. Hostilities most often take place among the population where it is difficult to distinguish benign population from committed adversary. The population has become “key terrain,” and, to limit civilian losses, precision strike is the preferred method of attack. In the urban and peri-urban environments, ground forces must maneuver not only on the surface, but also through subterranean spaces and inside and between multilevel, high-rise buildings. By 2030, commercial chemical and biological materials are more readily available and easily employed. Once anathema in the latter half of the 20th century, chemical and biological warfare, on a limited scale, is a constant threat as it has proliferated into the hands of non-state actors. This phenomenon tends to limit the maneuver options and operational tempo of traditional ground forces. Short of armed conflict, there is also frequent need for HA/DR operations, especially in and around the urban littorals due to the population density and fragile infrastructure.

Lastly, military forces frequently face numerous cultures, ethnicities, races, and languages, particularly in the complex urban and peri-urban areas. Understanding and adapting to these varied human and social factors is critical to accomplishing political and military objectives.

Economic

The strong correlation between economic power and national power persists in 2030-2045. Moreover, the shift in economic power forecast at the beginning of the century continues. With the world’s largest economy, China reported a GDP of \$36.1 trillion in 2030, and its share of world GDP peaked at 20 percent in the same year; its share is stabilizing just below 20 percent. The United States posted the second-ranked GDP in 2030 at \$25.6 trillion, and its share of world GDP amounts to 15 percent, matching the European Union share. India’s third-ranked \$17.1 trillion GDP represents roughly a 9 percent share of world GDP, but while others find their shares of world GDP stabilizing (China) or continuing to decline slightly (U.S. and European Union), India’s share continues to grow. Forecasts indicate that India’s share of world GDP will peak at almost 14 percent by 2045, overtaking both the United States and European Union. Rounding out the world’s top 10 national economies in 2030 were Japan (\$6 trillion), Indonesia (\$5.5 trillion), Brazil (\$5 trillion), Russia (\$4.9 trillion), Germany (\$4.6 trillion), Mexico (\$4 trillion), and the United Kingdom (\$3.6 trillion).²⁴⁹

Globalization has contributed to absolute economic growth in many poor nations. Despite this advancement in developing regions, the gap between the rich and poor nations has not narrowed substantially as improvement in GDP per capita in these regions has lagged. Additionally, advancements in global telecommunications, which led to greater access to mass media and the Internet, have exacerbated tensions between “haves” and “have-nots.” By 2030, the poor are more

²⁴⁹ John Hawksworth and Danny Chan, *The World in 2050: Will the Shift in Global Economic Power Continue?* (London: PricewaterhouseCoopers, 2015), 1-4.

acutely aware of disparities in wealth and quality of life between adjacent regions and nation-states, as well as between population groups within individual countries. The economic disparities are fueling social unrest, particularly in areas with poor governance. Areas of Africa and Southern Asia are particularly vulnerable to this destabilizing combination of economic disparity and poor governance. Moreover, these vulnerable regions pose a significant threat to global security and stability because they remain an important source of natural resources powering the global economy. Natural resource endowment should provide an avenue to prosperity within these nation-states by way of economic development and, eventually, diversification. However, exploitive and violent non-state actors often capitalize on governance weaknesses to disrupt the equitable distribution of economic benefits across their populations and productive reinvestment within their economies. Consequently, these regions remain prone to instability, often calling for intervention by global powers and coalitions whose interests lie in global stability and the status quo.

Actual military power of developed nations has become even more costly to maintain and difficult to employ as a means of influence. No longer are developed nations guaranteed an advantage in shaping the environment. Traditional U.S. alliances are weakening relative to emerging powers. An increasingly integrated global economy has changed the social and political dynamic, strengthening the position of newly developed or developing nations in international affairs. As a result of globalization and more sophisticated global supply chains, economic sanctions as a policy instrument are more difficult to impose and enforce, and they are no longer as compelling as they once were.²⁵⁰

Finally, as global trade continues to expand, potential conflicts in the vicinity of several major maritime chokepoints (Strait of Hormuz, Strait of Malacca, Suez Canal, Strait of Bab el-Mandab, Bosphorus, and the Panama Canal)²⁵¹ take on increased national and global significance. Seventy-five percent of U.S. goods move via these waterways. All are within or near the arc of instability. Thus, the political, military, economic, and social frictions surrounding these chokepoints, which could lead to local, regional, or even global instability, unrest, or outright conflict, are a vital U.S. policy concern.

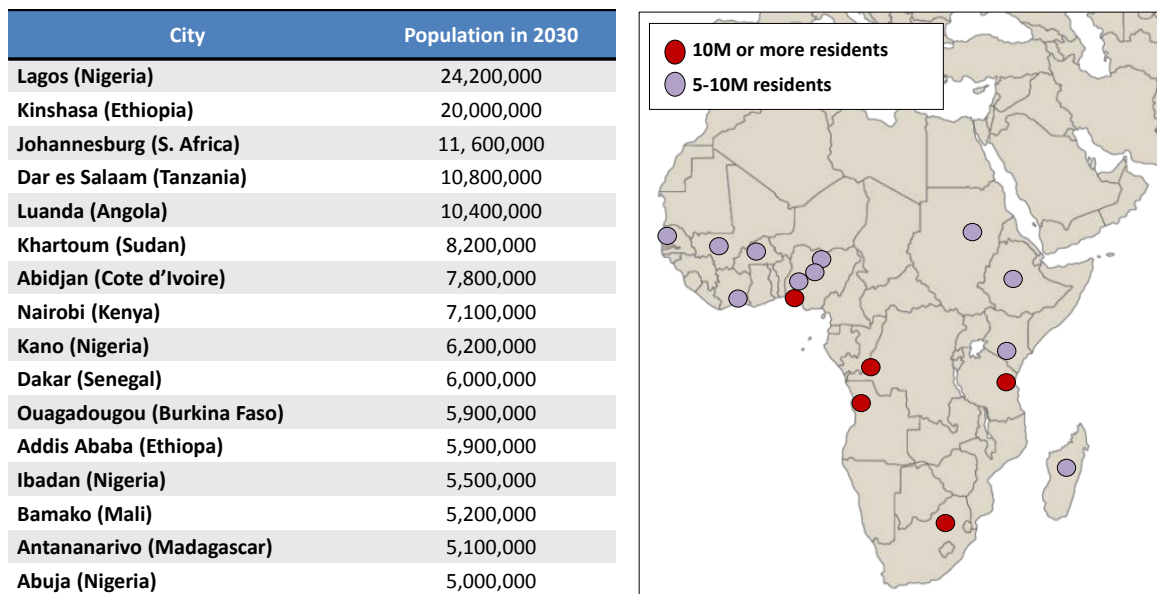
²⁵⁰ Chris Haliday, "Patterns and Trends Report: Economics" (report, Potomac Institute for Policy Studies, 2014), 7.

²⁵¹ Gus Lubin, "A Brief Tour Of The 7 Oil Chokepoints That Are Crucial To The World Economy," *Business Insider*, 5 February 2011, <http://www.businessinsider.com/oil-chokepoints-suez-canal-2011-1#>.

Social

A growing majority of the world's population resides in urban areas, with the largest concentrations in China, India, Nigeria, and the United States.²⁵² Although the pace of urban growth has slowed, people have continued to migrate towards urban areas in the littorals—mainly in Africa and Asia—in search of economic opportunity and social services. Sixteen of sub-Saharan Africa's largest and fastest growing cities (see figure 4-1) passed five million residents by 2030, many of whom reside in overcrowded slums.²⁵³ Five of these cities became megacities.

Figure 4-1. Africa's Fastest-Growing Cities



Data Source: United Nations, Department of Economic and Social Affairs, Population Division, *World Urbanization Prospects: The 2014 Revision, Highlights* (ST/ESA/SER.A/352), "File 12: Population of Urban Agglomerations with 300,000 Inhabitants or More in 2014, by Country, 1950-2030 (thousands)."

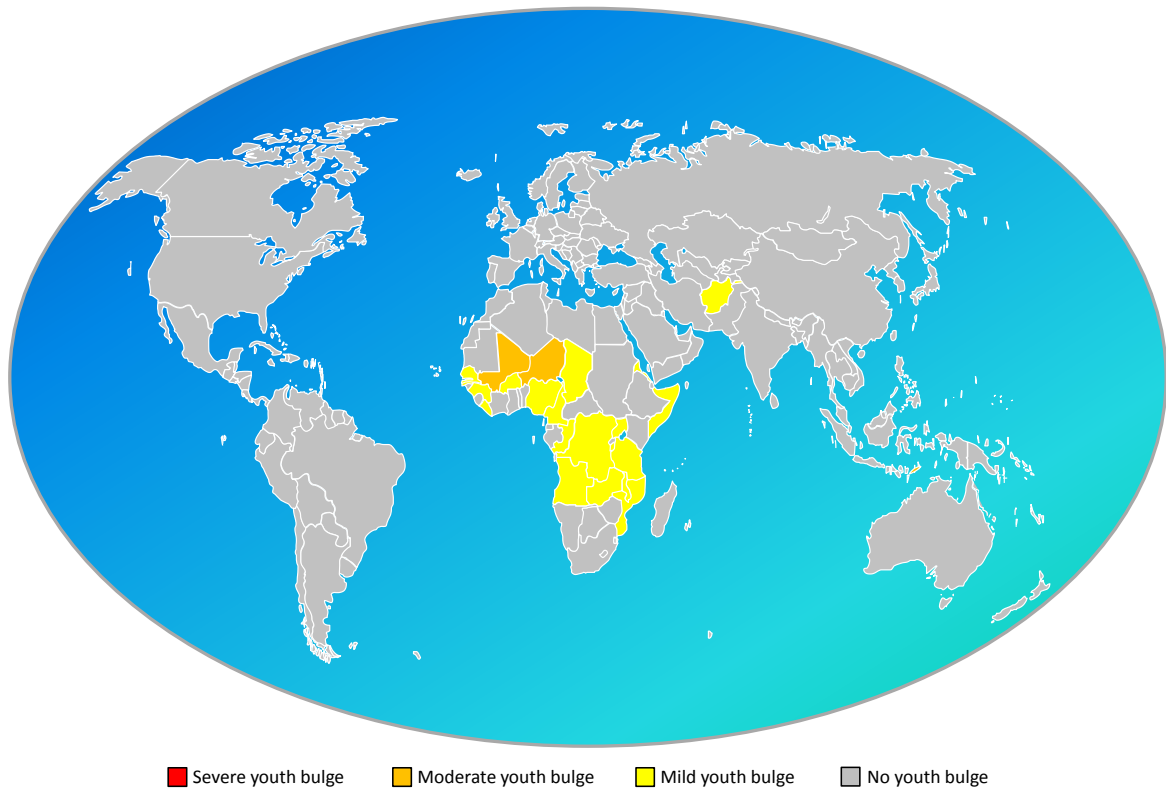
Moreover, all but two of the world's youth bulges in 2030 are located in Africa, with the remaining two in Afghanistan and East Timor (see figure 4-2).

Growing megacities in the developing regions are inherently unstable because chronic unemployment and underemployment exceed world averages and create hardship. The provision of food, water, and energy to these densely packed populations is unreliable. Governance is at a breaking point, except in affluent areas where money buys security, education, health care, and utilities services. Twenty to twenty-five percent of the world's population lives in unsanitary peri-urban slums and faces the consistent threat of diseases such as malaria, cholera, hepatitis,

²⁵² Shell Scenario Team, *New Lens Scenarios*, 14.

²⁵³ United Nations, *World Urbanization Prospects: The 2014 Revision*, 13-16 and 26-27.

Figure 4-2. Population Youth Bulges (2030)



Data Source: United Nations, Department of Economic and Social Affairs, Population Division, *World Population Prospects: The 2012 Revision* (ESA/P/WP.228), "File POP/9-1: Percentage total population (both sexes combined) by broad age group, major area, region and country, 1950-2100."

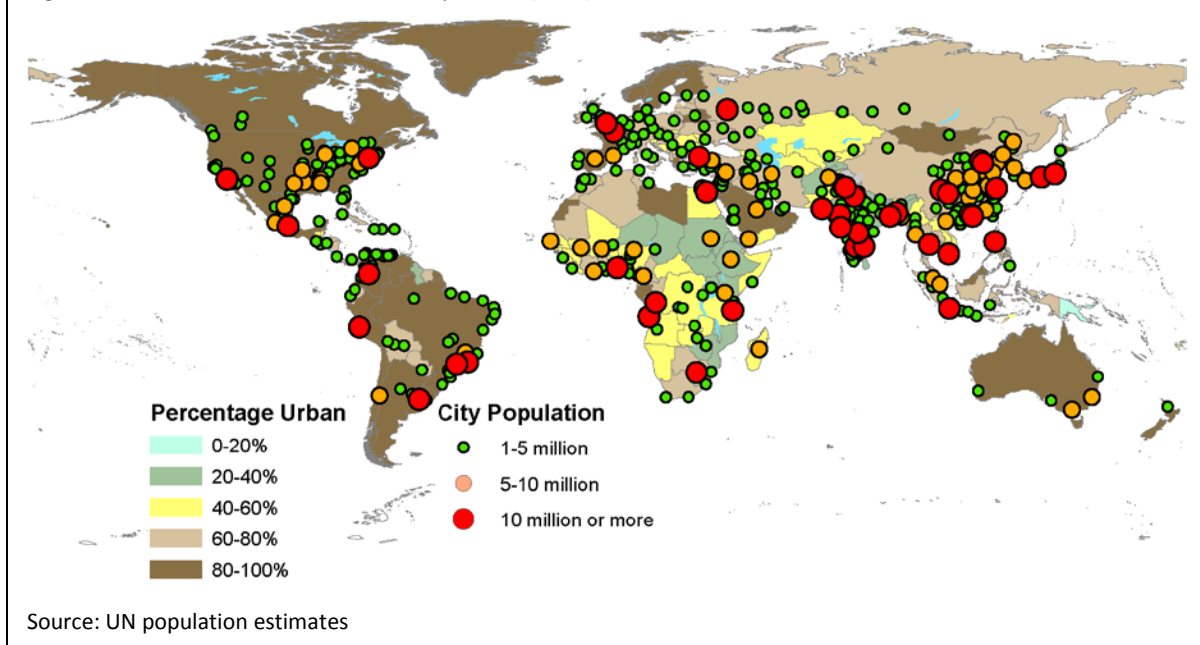
Note: The writing team adapted this taxonomy for assessing youth bulges from Cincotta, "Half a Chance," 10-12. Youth bulges are assessed as "severe" when the share of young adults (age 15-24) relative to the working age population (age 15-59) is 0.45 or greater; "moderate," between 0.40 and 0.45; and "mild," between 0.35 and 0.40.

tuberculosis, typhoid, and dengue fever. The combination of rapid urbanization, poor governance, inefficient infrastructure, porous borders, and lack of economic opportunity compounded by youthful populations exceeding 40 percent of the total population makes these locales vulnerable to violent extremist movements. Criminal, insurgent, and hybrid organizations, some with government ties, blend into the dense populations that they also exploit and disrupt.

Infrastructure

There are 41 megacities throughout the world by 2030, with most of them in the littorals (figure 4-3). Those in the developing regions are characterized by insufficient infrastructure to support their burgeoning populations. Unreliable food, water, and electricity and poor transportation systems impede outside investment interest and commercial development. Poor sewage, sanitation, waste disposal, and few, if any, water purification facilities exacerbate existing health risks. Limited access to potable water is common in the poorer areas of the megacity. A single extreme weather event or natural disaster may dramatically and even permanently destroy farm

Figure 4-3. Global Distribution of Urban Population (2030)



lands, fresh water sources, and the fragile distribution networks that do exist. What infrastructure does exist is unevenly—often perceived as unfairly—distributed throughout the urban environment, and this may be a catalyst of conflict.

Militarily significant infrastructure varies widely around the globe. Airports, seaports, and other transportation hubs that compose distribution networks are critical infrastructure, and their quality and capacities vary greatly. Particularly in the developing world, outmoded and poorly maintained road and bridge networks, often clogged with foot and vehicle traffic, are difficult to navigate and may be unusable for large, heavy, commercial and military vehicles, even in otherwise ideal conditions. In addition to normal surface topography, most megacities include subsurface features (e.g., subways, tunnels, and sewer systems) that have little, if any, accurate mapping and supersurface features (e.g., high-rise buildings and communications towers) that extend the surface dimension in novel ways. These developments add complexity to the battlespace. However, better-developed portions of large urban agglomerations may have sensor networks that can be used as primary sources of information and intelligence.

Infrastructure for water production and distribution is increasingly vulnerable and a potential friction point around the world. Since 2030, the world is using 40 percent more water than it did 15 years earlier. Agricultural use accounts for almost half of the increase. Because of infrastructure shortcomings and supply-demand mismatches, water security is a significant issue in the least developed regions that are still experiencing rapid demographic growth. According to the Water Security Risk Index, the top 10 countries with the greatest risk of water security are as

follows: Somalia, Mauritania, Sudan, Niger, Iraq, Uzbekistan, Pakistan, Egypt, Turkmenistan, and Syria.²⁵⁴ Water scarcity has severely impacted food production, further exacerbating demographic and economic stressors and increasing potential for social friction, humanitarian crisis, and possibly armed conflict.

Information

No longer are high-tech information tools, sophisticated telecommunications, and cyber capabilities the sole province of developed states. They are readily available to a wider array of less developed states and non-state actors. The change is greatest for non-state actors, as technology proliferation is providing them the ability to communicate with relatively greater speed, volume, and precision than in the past, increasing their reach and effect. Commercially available “Big Data” and the large variety of communication media now enable even the smallest organizations to tailor multiple narratives to multiple audiences. Non-state actors are able to interact with and influence large human populations on a scale comparable to that of organized states. Incidents or events that formerly went unnoticed now carry the potential to elicit mass reactions and emotions, potentially changing the course of events out of proportion to their inherent strategic significance.

The wide and near-instantaneous availability of information makes people more aware of political, economic, and social inequalities—whether real or perceived—and this accelerates the growth of identity-based or faith-fueled political and social movements. Social media, both on the open Internet and in dark networks, have become the primary setting for expressing anti-state and anti-establishment grievances and for mobilizing resources to support local and global causes. Around the world, governments continue efforts to censor information and control data to prevent the mobilization of people against the state. Governments and non-state actors alike use social media to manipulate public opinion and conduct propaganda campaigns to advance their agendas and discredit opposition.

The Internet is the principal means of individual and small-group empowerment. It continues to be non-state actors’ primary mechanism to facilitate recruiting, training, financing, and coordination. It is simultaneously and dichotomously a strength and vulnerability of international criminal and terrorist organizations, but states have not yet developed the means to constrain or eliminate its use by these belligerents without also inhibiting their own operations and influence in cyberspace. States increasingly find that the ability to effectively monitor, assess, and shape the information environment is essential to:

- Create sustainable political outcomes to support strategic aims;
- Compete against hybrid threats by extending influence beyond the physical battleground to public perception and political subversion;
- Conduct expeditionary maneuver and leverage a global land power network;

²⁵⁴ “Water Security Risk Index 2010,” *Verisk Maplecroft*, accessed 24 March 2015, <http://maplecroft.com/about/news/water-security.html>.

- Operate effectively in increasingly urbanized environments; and,
- Enable commanders to understand the cognitive, social, cultural, and political influences affecting human behavior and mission.²⁵⁵

The “Internet of Things” connects mundane but ubiquitous devices with sensors that can monitor all aspects of life and adjust the performance parameters of connected systems. This simultaneously offers great opportunity and creates potential vulnerabilities. The potential exists to harvest and present detailed, real-time intelligence to any user who can access, analyze, and interpret the data.

U.S. Role in the World

Beyond 2030, the United State continues to play a leading role in an increasingly multipolar world, even as other nations, notably China and India, and international or transnational organizations rise in political, economic, and military prominence. However, the U.S. encounters increasing competition in the political, economic, military, and social arenas from near-peer states and empowered non-state actors, including international criminal and terrorist organizations. Because of the greater complexity and balance in the international system, coalition action is the norm in the vast majority of conflicts. Individual state action is rare, and generally only at the sub-regional level. Some traditional U.S. partners are in the midst of demographic and economic decline, and their ability to contribute tangibly and regularly to the partnership is more limited than in the past. Consequently, the United States has begun to explore complementary and enduring partnerships with like-minded rising nations.

Continuing fiscal austerity, resulting in a decades-long drawdown of U.S. military forces, drives political decision makers to weigh military operations and interventions even more carefully than in the past. Additionally, combatant commanders find they must be more judicious in their actions, particularly their employment of kinetic weapons because of both their high financial cost and their potential, despite improved precision, for strategically disastrous collateral damage in the urban environment. The U.S. military regularly participates in HA/DR efforts within larger international efforts and in concert with regional engagement activities. The combination of densely populated areas and potent natural disasters creates a recurring need for humanitarian intervention on scales unseen decades earlier. However, the United States is no longer the sole first responder in HA/DR operations, and instances where the U.S. assumes the primary leadership are declining. Manifesting the increasing multipolarity in the global security environment, China and India continue to develop their military and civil response capabilities, demonstrating their desires to take more prominent leadership roles in the world and expand their political and economic influence.

²⁵⁵ Jason Spitaletta, “Information Operations and Information Warfare Threats 2030-2040” (lecture, Army War College [Unified Quest Workshop], 5 March 2015).

The United States does remain the front-runner in science and technology but no longer outpaces its adversaries by the substantial margins of the past. Fiscal austerity, increased program management scrutiny, and cumbersome acquisition policies are slowing innovation within the U.S. military relative to the militaries of competing nation-states. From a relatively less powerful military position than in the past, the United States relies more heavily on diplomatic efforts, taking unilateral action less frequently and negotiating and cooperating more than in the past.

Summary

In the multipolar world beyond 2030, the United States and its partners face near-peer state actors, as well as more sophisticated non-state actors empowered by the proliferation of technology and information. Adversaries are increasingly familiar with U.S. capabilities, tactics, techniques, and procedures, which are readily available on the Internet, and they often develop methods to neutralize traditional U.S. advantages. They recognize that the U.S. public is sensitive to world opinion, and the United States' strong and sustained desire to reduce both military and civilian casualties and limit collateral damage narrows its maneuver space during U.S. military operations. The increased number, size, and complexity of urban agglomerations around the world enables adversaries—particularly non-state actors—to gain an advantage by operating within the cities. As demographic, political, social, and technological trends continue, armed forces of both state and non-state actors increasingly operate in densely populated urban areas characterized by their poor governance and lack of resources, and often controlled by shadow organizations. Successful military operations demand a greater degree of multinational and interagency collaboration, and they require a more nuanced application of kinetic and non-kinetic means in a multidimensional battlespace.

Chapter 5

Worlds Dynamic, Dangerous, and Dry: Alternative Futures

"The herd instinct among forecasters makes sheep look like independent thinkers."

— Edgar R. Fiedler, *The Three Rs of Economic Forecasting—Irrational, Irrelevant, and Irreverent* (1977)

The baseline future in the previous chapter examined a world in which the patterns and trends introduced in chapter 2 continued on their projected trajectories. This chapter posits two plausible alternative futures that result by selecting pairs of trends, one pair per alternative future, and varying key aspects of these trends from their observed trajectories.

Overview—Alternative Future “A”

“Multipolar World: Increased Water Scarcity with Accelerated Migration”²⁵⁶

Despite early 21st century investment in agricultural optimization, global water conservation efforts proved to be too little, too late. The principal origins of increased water scarcity are twofold: decades-long changes in weather patterns (accompanied by rising ocean levels) and reduced winter mountain snowpack. These proximate natural causes are aggravated globally by overuse, poor water management, failing water infrastructure, and ineffective water restrictions, which result in black markets, illegal wells, and polluted aquifers. Water scarcity reached crisis levels worldwide shortly before 2030. This situation is contributing to accelerating and widening population migrations to regions that migrants believe have adequate water resources and offer economic opportunity. Unfortunately, those regions are unable to absorb and support the influx of humanity. Both sending and receiving regions now face humanitarian crises.

The developing world, which has always struggled with reliable access to fresh water, is particularly affected. Rapid population expansion in coastal megacities in sub-Saharan Africa, South America, South Asia, and the Middle East has overwhelmed fragile, poorly planned water

²⁵⁶ All basic attributes of the baseline future remain the same, except as noted.

infrastructures. Cities like Delhi, which in 2015 could reliably count on one to two hours of water per day,²⁵⁷ now may see a mere portion of an hour of municipal water every two or three days.

Meanwhile, in cities throughout the developed world, populations no longer take for granted clean drinking water, as they must often boil municipal water to guard against the threats of cholera and typhoid. Authorities must restrict industrial water use, affecting economies due to increased production costs. Water scarcity also affects the energy market. Rolling blackouts and brownouts grow more common in the southern and southwestern portions of the United States as water is frequently unavailable to operate power plants and excess electrical demand overloads distribution systems.

Dryland farming regions across the world are particularly hard hit by frequent, intense storms. Heavy rainfall, instead of soaking into the ground and eventually replenishing aquifers, washes away topsoil. This contributes to declining yields from crops intended both for human and livestock consumption, making fresh food scarce and raising the cost of living, particularly in the cities. As prices rise, the poor are especially hard hit and turn to their governments for relief. The growing global middle class, with its mounting demand for dietary animal proteins, has not accepted lab-grown substitutes as a suitable replacement for more natural, water-intensive, farm-raised meat.

Despite early 21st century investment in agricultural optimization, global water conservation efforts proved to be too little, too late....Water scarcity reached crisis levels worldwide shortly before 2030.

Deforestation, overgrazing, and poor agricultural practices accelerate desertification, particularly in developing areas. Frequent dust storms strip topsoil from farmlands, substantially limiting the ability to raise grain or the livestock that feed on it. Despite concerted efforts by the U.S. Department of Agriculture (USDA) Foreign Agriculture Service and U.S. Agency for International Development (USAID) over the preceding decades,

the United States has not made sustainable gains in exporting better agriculture practices. Similar efforts by other developed nations have found little success.

Urban migration continues, accelerated by what appears to be permanent ecomigration.²⁵⁸ People are leaving water-starved regions in droves and heading toward areas that appear appealing or that, anecdotally, appear to offer opportunity. Unfortunately, their arrival overtaxes infrastructure in the gaining regions, doubling the impact of the crisis in geographic terms.

²⁵⁷ Charles Fishman, *The Big Thirst: The Secret Life and Turbulent Future of Water* (New York: Free Press, 2011), Kindle edition, location 344-345 of 9837.

²⁵⁸ Ecomigration is population movement caused by destruction or severe degradation of essential natural resources. See William B. Wood, "Ecomigration: Linkages Between Environmental Change and Migration," in *Global Migrants Global Refugees*, eds. Aristide R. Zollberg and Peter M. Benda (New York: Berghahn Books, 2001), 50-51.

Key Attributes

Political

As a migration-destination country, the U.S. has attempted to increasingly restrict entry to better manage its absorption of immigrants, control the number of refugees, and curb illegal entry. This remains an enforcement challenge. It has been difficult for other nations to accept, as the U.S. has historically welcomed immigration and, in the present crisis, has not been as hard hit as other regions of the world. However, the U.S. continues to take a leading role in global efforts to mitigate the negative effects of water scarcity and accelerating migration. Other economic powers, specifically China and India, emerge to contribute more significantly to global problem solving, although India has also been hit hard by water shortage so its impact in this particular area is limited.

In many parts of the world, especially in some water-stressed African and South American countries, poor governance is adding to regional woes and contributing to mass emigration. Many receiving countries lack the capacity to accommodate these refugees. In affected regions, non-state actors profit by trafficking in black market water or imposing a passage tax on ecomigrants.

Military

U.S. and international leaders frequently call upon the U.S. military to respond to humanitarian and security contingencies around the world as a direct result of the global water crisis. Historically, while there have certainly been small-scale conflicts and disputes over water rights and control of resources, nations have not gone to war over water.²⁵⁹ The elevation of tensions as large populations migrate makes it seem as if this is about to change.

Two decades of U.S. military manpower drawdown and a shrinking Navy make it impossible to respond to multiple, simultaneous crises; authorities must prioritize and make frequent hard choices. With military assets and resources stretched thin, the U.S. often can allocate little more than planning and technical assistance to the hardest hit areas. Two locations require sustained, large-scale U.S. humanitarian assistance and peacekeeping presence: the Caribbean basin, hit by a recurring pattern of intense tropical storms, and Western Africa, plagued with continuing civil war and critical water shortages. The Middle East, South America, and South and Southeast Asia receive some U.S. military assistance for planning but receive a great deal more assistance from China, which has stepped up to fill the void left by the U.S. military drawdown. Non-state actors attempt to capitalize on poor governance and human misery in the affected regions, often disrupting government efforts to provide security and relief for migrant populations.

²⁵⁹ For an exhaustive list of water conflicts, see Pacific Institute, "Water Conflict," *The World's Water*, last modified February 2013, <http://worldwater.org/water-conflict/>.

Economic

Through continued advancement and application of technology, the developed world finds it relatively easy, compared to the developing world, to continue to improve efficiency in water use. Still, there is no breakthrough yet in cheap, low-energy, desalination processing, keeping water costs high even in coastal areas. Moreover, scientists and engineers have not solved the problem of disposing of toxic brine waste, adding to overall processing costs.

In the United States, both industry and agriculture confront increasing challenges. Water scarcity and expense have forced many water-intensive industries to move inland in closer proximity to fresh water sources in order to remain viable. The U.S. Midwest is seeing a second industrial boom thanks to its plentiful fresh water supplies. The movement is not without consequences, however, as it seems that industries that can afford to move away from the South and Southwest to water-stable regions are doing so in increasing numbers. State economies falter in water-starved areas and unemployment rises in the wake of industry's departure.

Many dryland farms in the southwest and high plains parts of the country are abandoned due to lack of rain and snow for irrigation water. The 40 percent increase in water demand since 2015 (almost half of that 40 percent being for food production) is causing a supply-demand mismatch as the water availability cannot keep pace. Innovation (for example, the ability to sustain crops in brackish water) is helping improve efficiency, but these efficiencies have not been enough to overcome the overall shortage of water or the cropland lost through abandonment.

In other parts of the world, globalization's economic benefits are beginning to falter. During the second half of the 20th century, globalization enabled industry, especially water-intensive industries such as textile production and electronics manufacturing, to relocate to parts of the world where labor was cheap, lifting large portions of the populations in these regions out of poverty. However, as water scarcity intensifies in many of these same regions, water competition between industrial and individual users creates an ironic crisis: "savior" industries that lifted up large populations in the developing world by providing employment are condemning these same populations to an existence without reliable and affordable access to drinking water. These affected populations become pools of potential migrants, and industries in affected parts of the developing world confront a diminishing labor force. This phenomenon begins to erode some of globalization's economic benefits in portions of the developing world. In the agricultural domain, water-efficient farming methods have not overcome cultural barriers and local traditions, despite some of the positive effects of globalization and the information age. This is accelerating the pace of water loss and squandering arable land.

Social

Having largely closed its borders and by managing immigration more carefully, the United States is handling migration both across and within its borders relatively effectively, and both types of migration are flowing toward the same regions within the country. Elsewhere, however, many countries are not readily accepting the immigration flows due to cultural difference and tensions.

Xenophobic locals fear that arriving immigrants will overstrain their water resources and, in many cases, this is proving true. The influx of migrants to Southern Europe places excessive strain on local water resources and aging water infrastructure, which leads to popular resentment. Violence against these water refugees is widespread, enabled and encouraged—rather than prevented—by social media.

In poorly governed areas, peacekeeping assistance requests become routine, and multinational military forces, which operate tentatively in complex urban environments, respond to maintain some semblance of global stability.

Infrastructure

In the U.S., water scarcity and migration lead to “winners” and “losers” in terms of infrastructure sustainment and renewal. Dilapidated skeletons of factories, warehouses, and farm-related infrastructure dot communities in the southwestern United States. The departure of industry and agriculture relieves much of the water strain, but failing state and local finances prevent reinvestment in local transportation and utilities infrastructure due to the declining tax base. However, industrial revival in the Midwest contributes to the large-scale renewal of its antiquated physical infrastructure after several decades of deterioration with only patchwork repair.

Many other parts of the world have similar experiences where regions are losing population. Abandoned areas without means of economic support quickly fall into disrepair. In regions gaining population due to the rapid and widening influx of migrants, however, the human flow expands too rapidly, overtaking methodical attempts to improve supporting infrastructure. Littoral megacities, both in the developed and developing regions, cannot effectively absorb and sustain the rapid inpouring of hopeful humanity, and many large cities find the needs of their peri-urban slums overwhelming.

China realizes a serendipitous benefit to prior investments. In the early 2000s, China built whole cities in anticipation of urban migration, which at the time never fully materialized. These heretofore sparsely populated cities are proving an ideal destination for domestic migrants leaving water-stressed regions. China is also directing limited international migration to these former “ghost towns,” but has been generally very protective of its borders and economy.

Information

The inexorable advance of technology was supposed to enable the information age and thereby make the entire catalog of human knowledge available to all of mankind. Ultimately, though, there was a roadblock: mankind. Despite the widespread availability of technology and information, cultural norms are difficult to overcome. Constrained by cultural tradition and inertia, some communities in critically affected areas ignore information and new techniques promoting water conservation and efficiency. Efforts at optimizing water-use technologies are proving, to a degree, to be successful in much of the developed world, but the environmental challenges posed by water shortage and desertification are proving irreversible in many areas. Unmoved by USDA and

USAID international outreach efforts, the hardest hit areas of the developing world seem, counterintuitively, to resist positive change in their water use habits and farming methods.

Governments recognize the value of information in managing the water- and migration-related crises. However, their deliberate attempts via social media and information operations to direct migrating populations toward areas whose infrastructure and resources can best sustain the influx, and not be overwhelmed, largely fail. People move to where they believe, often incorrectly, they will find relief from hardship, and they instead create or deepen hardship at their destination.

U.S. Role in the World

Still the preeminent world leader in this multipolar world, the U.S. continues to find itself the first nation toward which others look for leadership in crisis. Hampered by its own domestic water crisis and migration problems, though, the Nation is not as able or willing to expend strained human and financial resources to assist other nations in resolving their respective problems. Beyond 2030, the United States finds it must cede the leadership role in many cases to peer competitors or regional allies, while providing a modicum of military planning expertise along with limited technical and logistical support.

Summary—Alternative Future “A”

Parts of the world that heretofore enjoyed unfettered access to water for individual and industrial consumption are facing the consequences of their long-standing overuse of this vital resource. The United States is not immune from the detrimental effects of water scarcity. Additionally, despite nagging domestic economic issues and fielding the smallest military force—in both absolute and relative terms—in nearly a century, the United States copes with expectations that it remain actively engaged in humanitarian and peacekeeping missions around the world, as well as limited military interventions in support of vital national interests. While urbanization has introduced some efficiencies, cities that grew without detailed, efficient urban planning have pushed their new arrivals into slums on their periphery, where these immigrants find conditions no better than the ones they left behind. The worldwide crises in water and migration, together with the United States’ domestic problems, are creating opportunity for peer competitors to profit politically and for non-state actors to profit both politically and financially. For the United States to retain its preeminence on the world stage, government leaders must wisely and selectively engage parts of the world with military and financial assistance, and equally identify the parts of the world where they are willing to abrogate influence or rely more heavily on partners.

Overview—Alternative Future “B”

“Multipolar World: Declining U.S. Basic Research and Spreading Ruin-Causing Knowledge.”^{260,261}

The United States economy is no longer the sole global powerhouse, and budgetary restrictions have virtually eliminated federal government investment in basic research. Globalization and the democratization of technology have resulted in a multipolar world where “the rising tide raises all boats.” A2/AD technology is available to any country willing to make a modest investment, and many do. While advances in biological technology (biotech) have resulted in medical breakthroughs that prolong healthy, natural life, the unfortunate byproduct is a proliferation of ruin-causing knowledge throughout the Internet, making the world a dangerous place indeed.

By 2030, growing entitlement costs have overwhelmed the U.S. economy. An aging population and an expanding social safety net, coupled with flagging economic growth, have encroached upon federal discretionary spending. Funding for basic research in government institutions and at colleges and universities is at its lowest point since the early days of the Cold War. This results in a stagnation of research and development. Public officials encourage greater private investment in basic research, but the private sector is unable match the scale of former government investments.

China and India have become near-peer competitors and continue to invest in their own basic research. In the past, these rising nations made their acquisitions through technology transfer; now, young scientists and engineers display previously unseen innovation. A2/AD systems and their components are available for lease or sale, and many smaller countries make the investment, seeing these systems as a means to protect their borders at a cost far less than that of a standing army.

Biotech has experienced exponential growth in the last two decades, following a path similar to computing hardware as famously documented by Moore’s Law, which showed that the number of transistors in a dense integrated circuit doubled approximately every two years. By 2020, genetic manipulation software

Globalization and the democratization of technology have resulted in a multipolar world... the unfortunate byproduct is a proliferation of ruin-causing knowledge throughout the Internet, making the world a dangerous place indeed.

²⁶⁰ All basic attributes of the Baseline Future remain the same, except as noted.

²⁶¹ Ruin-Causing Knowledge is defined as, “[T]he core principles, core technology, and other core knowledge used to produce various products and schemes that can be used to cause devastating catastrophes, such as weapons of mass destruction.” See Yidong Liu, “The Biggest Challenge Facing the Knowledge Economy and Mode of Knowledge Creation with Lower-Risk,” in *ECKM 2007, 8th European Conference on Knowledge Management*, eds. Blanca Martin and Dan Remenyi (Reading, UK: Academic Conferences Limited, 2007), 574.

and gene-producing technology had moved out of universities and R&D labs and into the commercial marketplace. A brief visit to a doctor's office is all that is required to order a personalized, DNA-based cancer therapy designed to attack a specific patients' cancer cells with pin-point accuracy, while leaving healthy cells untouched. Unfortunately, the converse is true as well: biological weapons created to target a patient's healthy cells can be designed and ordered just as easily, in the same manner as a treatment, and delivered surreptitiously.²⁶² Custom disease vectors can be optimized for effect, targeting not just an individual, but whole groups or populations, spreading rapidly in densely-packed megacities. Kitchen-produced chemical or biological weapons, delivered in small amounts, at random, are virtually impossible to attribute to a particular source.

Ruin-causing knowledge has proliferated, enabled by the Internet, democratization of technology, and basic human curiosity. Advanced technical knowledge and equipment for close-tolerance machining are no longer prerequisites to capabilities based on ruin-causing knowledge; those can be outsourced. While nuclear materials have spread through direct transfer between nations, or through outright theft by non-state actors, the lingering effects from so-called dirty bombs are limited, and so far rogue actors have not pursued the tactic due to its marginal return on investment. Although globalization has resulted in readily available nuclear weapons technology and material, the effort required to maintain those weapons carries a similar burden of low return on investment. Non-state actors and state governments wishing to possess nuclear weapons have turned to a much cheaper alternative: biological weapons.

Military forces worldwide are targets of frequent threats, and providing for the security of the military's food and water supply expends a heavy tax on an already overburdened force.

Key Attributes

Political

The United States no longer possesses the international clout that it did as recently as two decades earlier. Other countries throughout the world recognize that the political power gap between the U.S. and its peer competitors has closed. China is becoming the country to which nations turn for technology innovations. Chinese and Indian investments in basic research, not only within their own borders but also in other nations' universities and firms, give them first access to innovations developed at those institutions.

Internally, the U.S. remains divided along party lines. Despite partisan and bipartisan attempts to curb ever-growing healthcare costs through the five previous administrations, no amount of effort seems to solve the Nation's social or economic ills.

²⁶² Andrew Hessel, Marc Goodman, and Steven Kotler, "Hacking the President's DNA," *The Atlantic*, November 2012, <http://www.theatlantic.com/magazine/archive/2012/11/hacking-the-presidents-dna/309147/>.

Countries that purchase A2/AD systems from abroad expose themselves to political manipulation by the selling country, which retains the “keys to the kingdom.” China, India, and to a lesser degree Russia are sponsors to numerous smaller countries that begin to develop international ambitions and expand political influence beyond their own borders, emboldened by their newly acquired “defensive” systems. Unwilling to engage militarily and unable to engage economically, the United States expresses its position in many regional matters primarily through diplomatic rhetoric.

Military

U.S. military forces are internally focused. The looming threat to personnel has made medical force protection a primary concern and slowed the military’s reaction times, since all deployments require development and implementation of extensive, tailored preventive health measures. Military deployments are more limited than in past decades. Except for some small forward-stationed garrisons required by treaty, most U.S. forces have redeployed to CONUS to cut costs. At home, the Nation’s military forces become even more isolated from the population they defend, secured behind fences and patrolled by unmanned systems programmed to detect any indications of chemical or biological aberrations in the environment. The U.S. Navy no longer sorties on routine deployments, leaving port only for contingency missions or when trans-oceanic shipping lanes are specifically threatened.

Custom viruses developed by competitor nations and non-state actors, and designed to attack opposing forces, are constructed to have prophylactic effect to protect their own forces. Although the U.S. can acquire access to many of these protective viruses, the massive number of possible genetic combinations makes it impossible to protect our force from all possible threats.

Because of worldwide investments in A2/AD systems, many developing countries make an investment in military technology instead of military personnel, saving long-term costs. This strategy has two noteworthy shortcomings: the smaller militaries are highly vulnerable to bio-attack and the A2/AD systems are vulnerable to cyber-attack, especially by the country that designed them.

Military spending continues to be held in check as a growing portion of the discretionary budget goes toward Health and Human Services divisions (Centers for Disease Control, Food and Drug Administration, and National Institutes for Health). Increased funding to defend against multiplying biotech threats eats away at the total defense budget.

Economic

One of the primary drivers of the increased entitlement budget has been upward-spiraling health care costs. Implementing a single-payer, health-care system as mandated by Congress in 2021 has not reined in rising costs. In order to make DNA therapies available to all, thus avoiding the perception that these therapies exist only for the wealthy, the government provides these therapies

as part of basic health care to which all U.S. citizens are eligible. By 2030, the average American, rich and poor, has a life expectancy into the 90s, far beyond historical Census Bureau projections.²⁶³ The added numbers to an already aging population is an additional fiscal encumbrance upon the expanding social safety net. Growing entitlement costs are overwhelming the U.S. economy. This, coupled with lackluster economic growth, pressures the remaining discretionary spending, which amounts to less than 20 percent of the federal budget.

U.S. technology corporations, enabled by globalization and having had their R&D funding cut, no longer feel particularly committed to the United States and its interests. They seek alternative revenue sources to fund their basic research. Global markets and competition force many smaller firms either to fold or take their business overseas. Moreover, international trade confronts a new challenge associated with technology proliferation. Trade routes are affected by the several smaller countries that possess A2/AD systems covering key transit choke points. These countries have begun to charge a passage tax, ostensibly to “ensure the security” of transiting commercial vessels as a protection against piracy.

Of particular concern, food trade is at a standstill. The fear of food-borne biological threats, which could decimate a country’s farms, has resulted in drastic trade restrictions. Most countries have restricted food imports by type and country of origin and trade only for essential food products that they are unable to produce within their own borders.

Social

Biotech breakthroughs have resulted in longer lifespans, but this phenomenon also slows the accumulation of wealth for the average American family, since there is less available to pass from one generation to the next. Retirement at age 65 generally vanishes as the “baby boomers” age out of the population, and multigenerational households continue to work to make ends meet.

Globally, urban growth continues, but at a decelerating rate. Fear of rapidly spreading, bioengineered viruses hinders urban growth, and the desire to leave cities swells within populations. The desire for safety and security in the face of the recurring threat of technology-powered disease overshadows any economic opportunity that the city affords. Urban industrial areas worldwide begin to lose their work forces. The poor who cannot afford to leave cities outright begin to move from the peri-urban slums to the relative safety of the city proper.

As R&D funding streams dry up and competing innovation centers multiply globally, U.S. colleges and universities begin a period of academic stagnation. They no longer receive foreign students in the numbers they had in previous decades, and they no longer command the premium

²⁶³ “2014 National Population Projections: Summary Tables—Table 17: Projected Life Expectancy at Birth by Sex, Race, and Hispanic Origin for the United States: 2015 to 2060,” *U.S. Census Bureau*, accessed 22 May 2015, <http://www.census.gov/population/projections/data/national/2014/summarytables.html>.

tuitions those student brought to their halls. Instead, universities in India and China, as well as those in smaller, developing countries, hire faculty previously trained in the U.S. and exploit their innovations.

Infrastructure

Bridges, dams, highways, railroads, and other infrastructure in the United States have continued to deteriorate due to a lack of continued capital investment. Public utilities come to operate almost exclusively off private funding sources, as the private sector acts to avoid the negative consequences of declining government investment and to guarantee reliable sources of water and energy. Circumstances have compelled national and regional governments to implement costly security measures to protect the Nation's food and water supplies from advanced biological threats.

Countries that have accepted extensive investment from other rising powers and enjoyed the resultant economic growth are able to make substantial infrastructure investments to keep pace with the rest of the world. Transportation and utilities infrastructure in South Asia, Central Asia, and South America see the greatest improvements.

Information

It is far too late to close the Pandora's Box that the Internet has become. Nearly any individual at any place on Earth can lay hands on any new piece of information or object practically imaginable within minutes. Some will find an alternate, nefarious use for even the most well-intended technological discoveries; the only limitation is the creativity of the human mind. Malefactors can quickly turn personalized cancer therapies into individually targeted assassination viruses. Terrorist and criminal organizations can download formulas for energetic explosives from any one of multiple, impenetrable dark webs on the Internet, and they can download plans for and fabricate a compact delivery device within minutes on a cheap, household, multimedia 3-D printer.

U.S. Role in the World

The United States is no longer the clear leader in the world. The economic rise of competitor nations and U.S. domestic budgetary constraints have combined to erode any technology advantage the United States previously enjoyed. The ambitions and efforts of rising powers undercut U.S. diplomacy, and U.S. military forces no longer operate with near impunity around the world. The United States, still the leader among Western countries, has become the primary target for both smaller nations and hyper-empowered actors desiring to make their presence known on the world stage—sometimes as lone actors and other times as proxies for peer and near-peer competitors seeking to gain dominance. Advanced A2/AD systems, supplied by China, India, and Russia, foster independence for former U.S.-supported partners around the world.

Summary—Alternative Future “B”

A stagnant U.S. economy, federal budget cuts, and the rise of competitors have had a crippling effect on the U.S. position in the world. The lack of investment in basic research has deep effects across all aspects of American society, weakening academic institutions and industry, and eroding the political, technological, and military dominance that the U.S. previously enjoyed. The ubiquitous threat of custom-engineered weapons, as well as the United States’ inability to maintain an advantage in this arena, has forced the Nation to hunker into a protective isolation. A2/AD systems proliferate around the world, threatening international trade as well as regional stability. Only when U.S. interests are directly threatened does the Nation step out to get involved. China and India take advantage of the United States’ diminished capacity in the world and expand their reach toward flourishing states seeking patronage and support in a dangerous world.

Chapter 6

World Accommodating: The Preferred Future

"Cutting up fowl to predict the future is, if done honestly and with as little interpretation as possible, a kind of randomization. But chicken guts are hard to read and invite flights of fancy or corruption."

— Ian Hacking, *The Emergence of Probability*

Overview

The United States remains a dominant power with global interests and global reach during the period 2030-2045, although competitors have emerged in recent decades. It continues to lead with purpose as a positive force, grounded in national interests that include “the security of the United States, its citizens, and U.S. allies and partners; a strong, innovative, and growing U.S. economy in an open international economic system that promotes opportunity and prosperity; respect for universal values at home and around the world; and a rules-based international order advanced by U.S. leadership that promotes peace, security, and opportunity through stronger cooperation to meet global challenges.”²⁶⁴ The United States confronts a more diverse array of competitors—near-peer nation-states, international terrorists and criminal organizations, nongovernmental organizations, and multinational corporations. All are more empowered than in the past owing to the effects of globalization, as are even smaller groups and individuals. Traditionally recognized boundaries are more porous and harder to control. As a result, unprecedented complexity is the most significant characteristic of the global security environment.

Key Attributes

Political

Beyond 2030, the United States is still a global political leader, working with and through the United Nations, North Atlantic Treaty Organization, and other international organizations, as well as with other coalitions, partners, and allies, to accomplish desired objectives. The U.S. cooperates

²⁶⁴ Executive Office of the President, *National Security Strategy 2015* (Washington, DC: Executive Office of the President, 2015), 2.

with like-minded nation-states worldwide to achieve a rules-based international order that observes human rights and dignity for all. It also acts on the international scene with greater credibility and influence than in the recent past because partisanship in the context of U.S. domestic politics has declined. On the domestic scene, American politics have grown less introspective, reassuring the global populace of United States leadership, which shapes and influences international behaviors and norms.

The United States is no longer the sole superpower. China and India are capable of challenging U.S. leadership, as evidenced by their abilities to secure portions of the global commons against threats from terrorism and extremism, as well as from non-state actors such as organized crime, traffickers, and pirates. As China's influence grew during the early 2010s, the United States

The United States remains a dominant power with global interests and global reach during the period 2030-2045, although competitors have emerged.

began “rebalancing” to the Asia-Pacific region to provide political, moral, and military support to partner nations primarily because five of seven major U.S. treaties were with Asia-Pacific nations (Japan, Philippines, Thailand, Australia/New Zealand, and the Republic of Korea). China's increasingly bellicose rhetoric, rapid military growth, and aggressive behavior towards neighbors led the United States to reevaluate the significance of regional stability and economic growth in the Western Pacific.²⁶⁵ Shifting a majority of its military capability to the region by the late 2010s, the United States achieved some success in tempering China's more aggressive political and military activities in the area. Since

2030, China maintains largely normalized relations with ASEAN member states, but still employs political, economic, and military strength to influence developing nations in Southwest Asia, Africa, and South America. In these regions, China competes with the West in economic and military domains, but Chinese political ideology gains considerably less traction given increases in the number of democratic governments in South and Southwest Asia, as well as Central and South Africa.

In the Middle East and North Africa, nation-states remain fragile and, to a degree, greater political power resides below and beyond the reach of the nation-state. Turkey is a politically and socially dominant nation-state in the region, taking a prominent political role due to the continuation of conflict and instability around Turkey's borders. Turkey's rise as a regional power, however, does not contain Iran's ambitions, which in turn impels the Gulf Cooperation Council states to enhance their own political and military capabilities with the aim of counterbalancing and containing Iran.

²⁶⁵ U.S. Department of Defense, *Sustaining U.S. Global Leadership: Priorities for 21st Century Defense* (Washington, DC: U.S. Department of Defense, 2012), 2.

Concerns over nuclear proliferation in the Middle East have re-emerged as an international challenge. Almost two decades ago through a political framework and eventual agreement with Iran, the major world powers negotiated a decade-long scaling back of Iranian nuclear ambitions. As part of the agreement reached in the late-2010s, the “P5 plus 1”²⁶⁶ lifted crippling economic sanctions on Iran in return for restraints aimed at demilitarizing Iran’s nuclear program. In the late 2020s, Iran abandoned its commitments and resumed its pursuit of nuclear weapons capability, setting off a cascading effect in the Middle East of nation-states pursuing nuclear parity by creating their own nuclear programs or purchasing capability from China, Russia, or North Korea. Through diplomacy, the U.S. attempts to dissuade its Middle Eastern partners from acquiring a counterbalancing nuclear capability, but these negotiations continue into the 2030s without resolution.

By the 2030s, Russia wields significant influence in the Arctic, having shifted focus in the late 2010s from its Western borders in response to heavy U.S. and UN sanctions. The depression that Russia goes through in the late 2010s into the early 2020s causes Russia to focus internally politically, economically, and militarily. While never fully withdrawing from the world stage, Russia loses near-peer competitor status to China and India.

Military

Even with military downsizing in the late 2010s, the United State maintains an active, credible, and lethal military deterrent worldwide. U.S. military forces remain both forward-stationed and forward-deployed, “assuring access to overseas regions, defending key interests in those areas, protecting [its] citizens abroad, and preventing [its] adversaries from leveraging the world’s oceans against”²⁶⁷ the United States. The U.S. military remains capable of defeating one large enemy in major combat operations in one region, while deterring another enemy in a different region.²⁶⁸ Major programs such as the F-35, F-22, Long Range Strike Bomber, and Gerald R. Ford-class aircraft carrier continue to ensure the technological advantages of the U.S. military, although competitors have reduced the gap in recent years. Moreover, the United States and its allies confront a broader array of advanced A2/AD capabilities, with China, Russia, North Korea, and Iran the principal architects. Finally, nation-states and non-state actors develop aggressive and innovative cyber warfare capabilities to negate U.S. technological advantages. In response, the government, in conjunction with the private sector, employs artificial intelligence and machine learning capabilities, developed during the late 2020s, to defend its networks and preserve its diminishing technological advantage.

²⁶⁶ The term refers to the five permanent members of the United Nations Security Council, namely China, France, Russia, the United Kingdom, and the United States, plus Germany.

²⁶⁷ U.S. Department of the Navy, *A Cooperative Strategy*, 1.

²⁶⁸ *Ibid.*, 27.

Continuing through 2025, China built one of the most advanced and integrated A2/AD networks encompassing sea, air, land, space, and cyberspace. This led to an arms race with the United States comparable in size and scope to the 20th century Cold War with the long-dissolved Soviet Union. In response, the United States developed and integrated the electromagnetic railgun, directed energy weapons systems, hypersonic weapons, advanced armed unmanned aerial vehicles (UAVs) and armed unmanned underwater vehicles (UUVs).²⁶⁹ The U.S. Marine Corps, in coordination with the Navy, explored the utility of establishing “oceanic outposts” to counter A2/AD capabilities,²⁷⁰ but ultimately decided to employ technology and redistribute Marines around the Pacific as the best response. U.S. rebalancing to the Pacific in the late 2010s and early 2020s continues to reassure allies and support regional stability against Chinese adventurism and aggression. Declining economic growth rates—along with domestic demographic, political, and social pressures—cause China²⁷¹ to normalize relations with its neighbors and assume a less aggressive posture in the early 2030s.

Following the major land wars and post-war stabilization operations in Afghanistan and Iraq during the first two decades of the 21st century, the U.S. Marine Corps remained at the vanguard as the Nation’s expeditionary force in readiness. To contribute to global security and “support distributed operations, fires, logistics, and intelligence”²⁷² in the littorals, the U.S. Navy recapitalized its surface connectors in the early 2020s.²⁷³ Combining these with vertical connectors, modernized equipment, amphibious shipping, and Maritime Prepositioning Force (MPF) shipping, U.S. naval forces refined tactics, techniques, and procedures for seabased operations. By 2030, seabasing is the dominant method by which the naval services forward-deploy and forward-station their expeditionary forces. Additionally, as part of the Asia-Pacific rebalance, the Marine Corps forward-stations approximately 5,000 Marines in Guam, continues to maintain an active Marine Expeditionary Force (MEF) headquartered in Japan, and deploys a Marine Rotational Force to Australia.²⁷⁴

By 2020, the U.S. Navy based approximately 60 percent of its ships and aircraft in the Indo-Asia-Pacific area.²⁷⁵ U.S. naval forces forward-based in Guam, Japan, Australia, Singapore, and the Philippines now maintain presence and deterrence against Chinese, Russian, and North Korean aggression. The U.S. Air Force also maintains 60 percent of its overseas forces in the Asia-Pacific

²⁶⁹ Ibid., 35.

²⁷⁰ U.S. Marine Corps, *Expeditionary Force 21* (Washington, DC: U.S. Marine Corps, 2014), 20.

²⁷¹ “Decade Forecast: 2015-2025,” *Stratfor Global Intelligence*, 23 February 2015, <https://www.stratfor.com/forecast/decade-forecast-2015-2025>.

²⁷² U.S. Marine Corps, *Expeditionary Force 21*, 32.

²⁷³ Ibid., 21.

²⁷⁴ U.S. Department of the Navy, *A Cooperative Strategy*, 11.

²⁷⁵ Ibid.

region. Additionally, the Air Force focuses a comparable share of its space and cyber capabilities in the region.²⁷⁶

The Navy and Marine Corps team continues the rotational deployment of carrier strike groups and amphibious ready groups, with embarked Marine Expeditionary Units (MEU), in the seas adjacent to the Middle East and North Africa. The Marine Corps also maintains a continuous, land-based presence in the Middle East, including a general officer-led Marine Air-Ground Task Force (MAGTF) command element and a Special Purpose Marine Air-Ground Task Force (SPMAGTF) equipped with MV-22 Osprey and KC-130 Hercules aircraft to maximize the operating radius for security cooperation and crisis response.²⁷⁷

Recognizing the enduring importance of NATO and European allies and partners, the United States continues to sustain land- and sea-based forces in Europe and adjacent areas well into the mid-2040s. In doing so, U.S. forces are effectively positioned to conduct prompt, flexible operations in Europe, Africa, the Levant, and Southwest Asia in support of national objectives.²⁷⁸

Demand for assistance and intervention by military forces across the range of military operations continues unabated during the period 2030-2045. The United States, China, and coalition partners conduct numerous HA/DR operations around the world due to an upswing in major natural disasters in the 2030s.²⁷⁹ Responding as part of coalitions and, when required, unilaterally, major world powers share the burden of support in times of need.²⁸⁰ Toward the other end of the conflict spectrum, sectarian violence in failing states fueled by non-state actors, including terrorist and criminal organizations, pirates, and traffickers, threatens regional stability, particularly in the Middle East and across Africa. As part of a hyper-connected world, these threats increase the importance of developing a global network of cooperative and inter-operational naval forces.²⁸¹ The U.S. devotes significant military resources to both counter-terrorism and security force assistance missions well into 2030s.²⁸² Additionally, employing special operations forces more often than conventional forces, the United States continues to combat terrorism and violent extremism.

Finally, the United States continues to maintain “a safe, secure, and effective nuclear deterrent that preserves strategic stability”²⁸³ globally with “an assured, precise, nuclear second-

²⁷⁶ Karen Parrish, “U.S. Following Through on Pacific Rebalance, Hagel Says,” *U.S. Department of Defense*, 1 June 2013, <http://www.defense.gov/news/newsarticle.aspx?id=120186>.

²⁷⁷ U.S. Department of the Navy, *A Cooperative Strategy*, 13.

²⁷⁸ *Ibid.*, 14.

²⁷⁹ U.S. Marine Corps, *Expeditionary Force 21*, 9.

²⁸⁰ Angela E. Kershner, “Disaster Management Exchange 2015 Concludes in China,” *www.army.mil*, 26 January 2015, http://www.army.mil/article/141698/Disaster_Management_Exchange_2015_concludes_in_China/.

²⁸¹ U.S. Department of the Navy, *A Cooperative Strategy*, 4.

²⁸² U.S. Department of Defense, *Sustaining U.S. Global Leadership*, 4.

²⁸³ Executive Office of the President, *National Security Strategy 2015*, 11.

strike capability.”²⁸⁴ This nuclear deterrent remains robust well beyond the Korea denuclearization of the 2030s, as indications during the late 2020s pointed toward Iran reinvigorating its pursuit of nuclear power status after 2030. Several U.S. partners in the Middle East begin to explore counterbalancing nuclear capabilities in response. The United States attempts to dissuade them from doing so, but appears unwilling to extend its nuclear umbrella to the Middle East as a means to this end, so the risk of nuclear proliferation persists through the 2030s.

Economic

China is the world leader in gross domestic product (GDP), having surpassed the United States and European Union around 2025.²⁸⁵ Despite China’s economic primacy in terms of total productive capacity, the U.S. remains “a strong, innovative, and growing economy in an open international economic system.”²⁸⁶ Moreover, the U.S. retains its top spot in terms of average income levels (GDP per capita) through 2045, while large emerging countries such as China, Brazil, Indonesia, and India continue to trail. However, the GDP per capita differentials between the United States and the larger developing nations do close significantly up to and through the forecast period (e.g., China’s GDP per capita as a proportion of U.S. levels reached 34 percent in 2030, up from 18 percent in 2011). Thus, the United States maintains an advantage, albeit a diminishing advantage, in the economic capacity to mobilize resources for national defense.

Operating in and influencing the global economy is more challenging than in the past, since the U.S. finds that “power among states is more dynamic. The increasing use of the Group of Twenty (G-20) on global economic matters reflects an evolution in economic power, as does the rise of Asia, Latin America, and Africa.”²⁸⁷ The United States strengthens its “strategic and economic partnership with India”²⁸⁸ while working with Canada, Mexico, Chile, and Peru²⁸⁹ to enhance its collective economic competitiveness to advance prosperity in the Western hemisphere, favoring open trading systems. “The increasing interdependence of the global economy and rapid pace of technological change...link individuals, groups, and governments in unprecedented ways.”²⁹⁰ “Focusing on lowering tariffs on [U.S.] products, breaking down barriers to [U.S.] goods and services, and setting higher standards”²⁹¹ on international imports, the U.S. advanced its trade agenda during the 2020s to create and “re-shore” jobs. These efforts restored vitality and resilience to the U.S. economy

²⁸⁴ U.S. Department of Defense, *The National Military Strategy of the United States of America 2011* (Washington, DC: U.S. Department of Defense, 2011), 19 and U.S. Department of the Navy, *A Cooperative Strategy*, 22.

²⁸⁵ “World Economic League Table: 2015 Highlights,” *Centre for Economics and Business Research*, 26 December 2014, <http://www.cebr.com/reports/world-economic-league-table-2015/>.

²⁸⁶ Tanya Somanader, “President Obama’s National Security Strategy in 2015: Strong and Sustainable American Leadership,” *The White House Blog*, 6 February 2015, <https://www.whitehouse.gov/blog/2015/02/06/president-obamas-national-security-strategy-2015-strong-and-sustainable-american-lea>.

²⁸⁷ Executive Office of the President, *National Security Strategy 2015*, 4.

²⁸⁸ *Ibid.*, 24.

²⁸⁹ *Ibid.*, 27.

²⁹⁰ *Ibid.*, 4.

²⁹¹ *Ibid.*, 17.

beyond 2030, permitting the Nation to avoid the economic fate of other nations that are stagnating due to demographic decline.

U.S. federal budget sequestration²⁹² ended in 2021 as the Budget Control Act (BCA) of 2011 ran its course. The BCA, as intended, lowered spending by approximately \$1.1 trillion versus pre-sequester levels over the 8-year period from 2013 to 2021.²⁹³ Although causing significant turmoil in both non-defense and defense discretionary spending, sequestration helped reduce the U.S. budget deficit, thereby strengthening the Nation's credit rating and "leveraging a strong and well-regulated economy to promote trade and investment while protecting the international financial system from abuse."²⁹⁴

Ending extreme global poverty by 2030 was long a U.S. national goal.²⁹⁵ Working with global partners to develop a sustainable agenda to this end, the U.S., European Union, and other developed nations collaborate to bring about a dramatic global decrease in populations living in extreme poverty. In a 2011 analysis, "17 percent of people in the developing world [were] living at or below \$1.25 a day."²⁹⁶ By 2040, extreme poverty affects only five to seven percent of worldwide citizenry.

Energy merits special attention during 2030-2045. The relentless increase in global energy demand through 2040 sustains energy-producing nations and "underscores the criticality of the free flow of commerce through strategic maritime crossroads including the Straits of Hormuz and Malacca, as well as the Panama and Suez Canals."²⁹⁷ *National Security Strategy 2015* promoted "diversification of energy fuels, sources, and routes, as well as encourage[d] indigenous sources of energy supply." It advocated "increasing global access to reliable and affordable energy,"²⁹⁸ which supports economic and social development worldwide. To reduce Department of Defense energy demand, the U.S. public and private sectors collaborated in the 2010s to introduce substantial efficiency into expeditionary energy consumption. These improvements eventually migrated to worldwide commercial applications, helping to "reduce the potential for energy-related conflict"²⁹⁹ in the ensuing decades.

In addition to economic developments in the United States and China, those in several other countries significantly shaped the present global economic landscape. Throughout the late 2010s

²⁹² Sequestration, specifically the federal budget sequestration of 2013, refers to the automatic spending cuts to U.S. federal government spending in designated categories of outlays that take effect if certain budget reduction targets are not met.

²⁹³ "CBO Estimated Impact of Automatic Budget Enforcement Procedures Specified in the Budget Control Act," *Congressional Budget Office*, 12 September 2011, <https://www.cbo.gov/publication/42754>.

²⁹⁴ Executive Office of the President, *National Security Strategy 2015*, 4.

²⁹⁵ *Ibid.*, 17-18.

²⁹⁶ "Poverty Overview," *The World Bank*, 7 October 2014, <http://www.worldbank.org/en/topic/poverty/overview>.

²⁹⁷ U.S. Department of the Navy, *A Cooperative Strategy*, 6.

²⁹⁸ Executive Office of the President, *National Security Strategy 2015*, 16.

²⁹⁹ *Ibid.*

and early 2020s, multiple factors led to the ruin of the Russian economy, driving it into deep recession:

- Russia's willingness to manipulate European dependence on Russian natural gas for political ends, which caused European nations to diversify their energy sources away from Russia;
- U.S. and European Union economic sanctions against Russia for actions in Crimea in 2014;
- A chronically weak ruble; and,
- Saudi Arabia's steadfastness, during the mid-2010s, to maintain high levels of oil production in order to avoid giving up market share and to retard the North American shale boom.

During the late 2020s, however, Russia reversed the trend, finding new natural resources in an arctic region made more accessible by melting arctic ice and corresponding expansion of the navigable area of the Arctic Ocean. Capitalizing on these newly accessible resources and on increasing exports to China, while subsequently decoupling from the European Union, Russia continues to hold fast through 2040 as the world's 10th largest economy.

Russia's relative economic decline and eventual stabilization, combined with provocative diplomatic, military, and economic maneuvers from China in the mid-2010s through early 2020s, drove Japan to bolster its domestic military industry. By 2024, Japan has slipped to the fourth largest economy but has formed a dynamic and strong offensive military force. That military might, combined with a renewed sense of nationalism, makes Japan a powerful U.S. ally in the Asia-Pacific region.

India continued its economic development, becoming the third largest economy by GDP in 2024,³⁰⁰ surpassing Japan. Collaborating with the United States and China in the mid-2010s on a variety of projects and capitalizing on relatively cheap labor, India achieved financial success. More people were lifted out of poverty in the 2020s than in any single decade in India's past, advancing a significant portion of the U.S. agenda to end extreme poverty by 2030.³⁰¹ Beyond 2030, a growing middle class continues to demand economic, social, and political change, which firmly anchors India among the world's democratic nations and supports India's position as a U.S. partner in maintaining the international order.

Social

"Defending democracy and human rights is related to every enduring national interest,"³⁰² and this has been consistent in U.S. strategy for many decades. For example, *National Security Strategy 2015* clearly defined the need for progress in the areas of democracy and human rights. The United States, using soft and hard power, strives to help people struggling against tyranny and oppression around the world to achieve greater degrees of self-determination. By 2040, more

³⁰⁰ "World Economic League Table," *Centre for Economics and Business Research*.

³⁰¹ Executive Office of the President, *National Security Strategy 2015*, 18.

³⁰² *Ibid.*, 20.

nations in Africa, East Asia, Eastern Europe, Latin America, and the Middle East are democracies.³⁰³ While dictatorships, oligarchies, and communism persist, they are less common than in 2015.

Social instability triggered by “climate change-enhanced storms, rising sea levels, and coastal flooding”³⁰⁴ disproportionately affects many island nations as well as coastal urban areas, to include numerous megacities. By 2030, poorer nations and poorer populations are most adversely affected and least able to cope with the worst effects of climate change. Migrations increase in frequency and scale as the poor move toward the urban littorals. Influxes of people of different religions, ethnicities, tribes, and family and belief systems create new tensions. Moreover, increasing migration begins to overburden social welfare infrastructure in places already struggling to cope with societal issues.³⁰⁵ Population growth and urbanization in the Middle East, Africa, and South Central Asia have contributed to increasing water scarcity by 2030, magnifying the current challenges. Demand for intervention by nongovernmental organizations, intergovernmental organizations, and multinational militaries remains high. Consequently, HA/DR operations are frequent occurrences. Financing these missions grows challenging as most developed nations face demographically induced fiscal pressures on discretionary spending; thus, multilateral cooperation and interoperability is vital to wring maximum efficiency out of all aid-related international initiatives and crisis responses.

Infrastructure

Maintaining a technological advantage relative to all adversaries remains a U.S. national priority, as it has been for decades. Partnering with industry, pushing the bounds of science, and utilizing commercial off-the-shelf technologies, the United States maintains its superiority of physical and networked capabilities well into the 2040s. China, Russia, India, Germany, and some non-state cyber actors create imaginative and inventive counter-technologies during this time in an effort to challenge or compete with U.S. dominance.

Continuing efforts to decrease vulnerabilities and increase resilience in the Nation’s infrastructure, the U.S. government worked during the 2010s and 2020s “with the owners and operators of...[the Nation’s] critical cyber and physical infrastructure across every sector—financial, energy, transportation, health, [and] information technology.”³⁰⁶ For example, based on the identified need to improve the Nation’s transportation infrastructure, the White House proposed in the 2013 Fiscal Year Budget “a \$50 billion up-front investment connected to a \$476 billion six-year reauthorization of the surface transportation program.”³⁰⁷ By the early 2020s, major road, bridge, rail, and mass transit projects received significant upgrades, providing more robust transportation

³⁰³ U.S. Department of Defense, *Sustaining U.S. Global Leadership*, 3.

³⁰⁴ U.S. Department of the Navy, *A Cooperative Strategy*, 6.

³⁰⁵ Canty, “Climate Change,” 5.

³⁰⁶ Executive Office of the President, *National Security Strategy 2015*, 9.

³⁰⁷ U.S. Department of the Treasury, “A New Economic Analysis of Infrastructure Investment” (report, U.S. Department of the Treasury, 2012), 5.

alternatives and improving economic competitiveness, while also improving the lives of average citizens.³⁰⁸ These improvements contributed to the continued three to five percent annual GDP increase, sustaining U.S. economic growth. Additionally, part of the transportation infrastructure improvements included “adopting a next generation air traffic control system (NextGen)”³⁰⁹ that yielded substantial savings annually by 2026. Those monies were in turn recapitalized into the energy sector, expanding renewable energy research, development, implementation, and utilization.

To ensure a more resilient, responsive, and secure power grid, the United States began building a smart grid from the ground up. The “smart grid” enabled two-way communication between electrical utilities and their customers, which increased current network efficiency, and it supported the increased use of clean energy by 2030.³¹⁰ The 2011 Recovery Act investment of \$4.5 billion, along with public-private investment of \$5.5 billion, modernized electricity delivery and energy reliability, while “including both utility scale generation systems such as large wind turbines and distributed generation systems such as rooftop solar panels.”³¹¹ By 2030, the United States’ smart power grid was completed and ready for the challenges of the next 50 years.³¹²

Finally, starting in the late 2020s, developing countries in Africa, Latin America, and South Asia began to consume more energy than developed countries, and this trend continues. As such, energy flows and consumer relationships change. Alternative energy research, development, and refinement during the first decades of the 21st century enabled developing countries to integrate a larger portion of mature and cheap alternative energies such as solar, wind, and hydrothermal into their economies. This investment in modern energy infrastructure stimulates growth and, in turn, improves energy efficiency in the world’s fastest growing economies.

Information

Globalization has connected the world in unprecedented ways. State and non-state actors exchange ideas, money, technology, and products—directly and indirectly, intentionally and unintentionally—much more freely and rapidly than at any time in human history. Local and regional incidents often have global impacts. The United States works diligently with partners, allies, and coalitions to maintain stability and promote international norms in the information domain.

As nations and non-state actors gained offensive and defensive information capabilities through 2030, the U.S. need for reliability in the information domain became ever more critical. “The world is connected by shared spaces—cyber, space, air, and oceans—that enable the free flow

³⁰⁸ Ibid., 11.

³⁰⁹ Ibid., 13.

³¹⁰ Executive Office of the President, *A Policy Framework for the 21st Century Grid: Enabling Our Secure Energy Future* (Washington, DC: Executive Office of the President, 2011), v.

³¹¹ Ibid.

³¹² “Technology,” *The White House*, accessed 23 April 2015, <https://www.whitehouse.gov/issues/technology#id-3>.

of people, goods, services, and ideas...[but] access is at risk due to increased competition and provocative behaviors.”³¹³ During the period 2030-2045, the United States seeks to maintain its freedom of action in cyberspace by increasing its investment to keep pace with potential adversaries.

Competition within the information domain is particularly acute. Nations and non-state actors, unable to challenge traditional U.S. technological dominance, turn to cyberspace and the electromagnetic spectrum seeking advantages. Adversary activity in the information domain seeks to extract economic gains, destabilize global financial institutions, influence U.S. and allied behavior across other domains, and deny U.S. and allied usage of cyberspace and the electromagnetic spectrum. For the United States, partners, and allies, operations in cyberspace are a core aspect of national security. The protection of cyberspace and the electromagnetic spectrum remains an enduring mission for the joint force long into the 2040s. Frequently probed and attacked, U.S. public and private sector entities employ advanced technologies, including machine-learning and autonomous software applications, to defend, repel, and counter threats.

Additionally, social media behemoths of the early 21st century, such as Google, Facebook, and Twitter, accumulated mountains of data and information, giving the private sector the ability to track, exploit, and influence public opinion. Innovation during successive waves of social media applications dramatically increased the power inherent in “Big Data,” as well as global connectedness over the succeeding 30 years. Governments attempt to restrain the growing power of profit-seeking commercial actors in the information domain by establishing standards and controls on handling, access to, and distribution of data and information.

In April 2011, for example, the White House published *The National Strategy for Trusted Identities in Cyberspace*, which envisioned an “identity ecosystem” that established clear privacy rules. The identity ecosystem set baseline behavior of participants—that is, it “cover[ed] not only the circumstances under which participants may share information, but also the kinds of information they may collect and how it is managed and used. In particular, the rules...ensure[d] that websites do not ask for more identification than they need.”³¹⁴ Working with the World Wide

Following the Asia-Pacific Rebalance, Asia security and stability normalized by 2030. Sixty percent of U.S. military capabilities are situated in the region, and the United States works with strong Japanese, South Korean, Australian/New Zealand, and Southeast Asian partners to maintain stability.

³¹³ Ibid., 12.

³¹⁴ Howard A. Schmidt, “The National Strategy for Trusted Identities in Cyberspace and Your Privacy,” *The White House Blog*, 26 April 2011, <https://www.whitehouse.gov/blog/2011/04/26/national-strategy-trusted-identities-cyberspace-and-your-privacy>.

Web Consortium and the United Nations, the United States and European Union were at the forefront of championing online privacy rights throughout the late 2010s. Globally adopted in the early 2020s, except by China, North Korea, and Iran, the identity ecosystem became the standard. These government and intergovernmental initiatives achieve some success, although their ability to regulate the flow of information is diminishing.

U.S. Role in the World

With a strong, technologically advanced, forward-based, regionally and globally oriented military, the United States secures the homeland and contributes to the safety and security of partners, allies, and international coalition members, remaining “first among equals.”³¹⁵ U.S. leadership is essential for global prosperity, strengthening the global financial system through economic and energy resiliency and security. Working to end extreme poverty, the United States also promotes and seeks global human rights and equality, online and in the physical world. U.S. leadership and partnership also positively influence global environmental protection and responsibility. Having set ambitious goals to reduce carbon emissions back in 2014, the United States sees global carbon emissions reduced by 20 percent by 2035 relative to 2005 levels.

Following the Asia-Pacific Rebalance, Asia security and stability normalized by 2030. Sixty percent of U.S. military capabilities are situated in the region, and the United States works with strong Japanese, South Korean, Australian/New Zealand, and Southeast Asian partners to maintain stability. In Europe and adjacent areas, the United States continues to sustain land- and sea-based forces well into the mid-2040s. This force posture positions the U.S. to conduct prompt, flexible operations in Europe, Africa, the Levant, and Southwest Asia as needed.

Working in tandem with other nation states as well as non-governmental organizations, the United States conducts numerous HA/DR operations around the world due to an upswing in major natural disasters. While financially costly and manpower intensive, U.S. assistance continues to stabilize those regions most desperately in need of help. The Nation’s military continues to combat terrorism and extremism around the world predominately utilizing special operations forces rather than conventional forces. Working in conjunction with other governments and their special forces, terrorism and extremism make the occasional sensational headlines, but they do not make significant inroads beyond the Middle East.

Summary

Beyond 2030, the United States is the chosen partner, setting and leading rules-based international order that promotes global security, democracy, and equal rights for all humankind. The U.S. economy is strong and vibrant, benefitting the American worker. U.S. citizens are safe in the

³¹⁵ National Intelligence Council, *Global Trends 2030*, x.

homeland and abroad, secure in the knowledge that, although their military is smaller than in the past, it is prepared and capable to defend the Nation. Land, air, sea, space, and cyberspace are secure against regional and global state and non-state actors that operate counter to U.S. interests. The U.S. rebalance to the Asian-Pacific in the 2010s, along with Chinese normalization of relations with ASEAN partners in the early 2020s, brought security and economic prosperity to the region. Continuing active U.S. participation in NATO contributes to European security. The Middle East and Africa, however, remain problematic, unstable regions. These two regions in particular remain vulnerable to non-state actors and state proxies that capitalize on human suffering, weak economies, poor governance, and the grievances borne of oppressive regimes to advance their agendas.

Chapter 7

Recap and Way Forward

"If you can look into the seeds of time, and say which grain will grow and which will not, speak then unto me."

— William Shakespeare

The dissolution of the Soviet Union in 1991 punctuated the end of the 20th century's bipolar world order, and it marked the beginning of a period of transition in the political, military, economic, and social relationships among the world's actors. After passing through a "unipolar moment,"³¹⁶ the world, according to the varied judgments of experts, analysts, and pundits, appears to have taken on a multipolar form.³¹⁷ Recently, however, some are recognizing that, in addition to the proliferation of the world's power centers, there is an emerging layered complexity to the current transition in the world order. More than multipolar, the world is becoming "multiplex" in character. In an article based on his new book, *The End of American World Order*, Amitav Acharya, professor of international relations at American University, writes, "A multiplex world is like a multiplex cinema....The multiplex cinema [analogy] is more apt—several movies running in different theatres within a single complex....No single director or producer would monopolize the audience's attention or loyalty for long....A multiplex world comprises multiple key actors whose relationship is defined by complex forms of interdependence."³¹⁸ This recent interpretation of the global environment suggests that the transition in the world order continues even today.

In a transitioning world, forecasting with any sort of exactitude is, as discussed at the beginning of this paper, a daunting task. Still, forecasts abound because gaining insight on the future, however limited or imperfect, is vital to planning and preparing for the future. To support Marine Corps preparations for the future security environment, this MCSEF followed a structured approach to generate multiple possible futures: baseline, alternative, and preferred futures. Exploring these futures helps uncover implications, issues, and opportunities. Planners may then

³¹⁶ Charles Krauthammer, "The Unipolar Moment," *Foreign Affairs* 70, no. 1 (1991): 23-33.

³¹⁷ See, among others, Stanley Hoffmann, "A New World and Its Troubles," *Foreign Affairs* 69, no. 4 (1990): 115-122; Charles W. Kegley, Jr. and Gregory A. Raymond, *A Multipolar Peace?: Great-Power Politics in the 21st Century* (New York: St. Martin's Press, 1994); Samuel P. Huntington, "The Lonely Superpower," *Foreign Affairs* 78, no. 2 (1999): 35-49; Richard N. Haass, "The Age of Nonpolarity: What Will Follow U.S. Dominance," *Foreign Affairs* 87, no. 3 (2008): 44-56; Dilip Hiro, *After Empire: The Birth of a Multipolar World* (New York: Nation Books, 2009); Graeme P. Herd, ed., *Great Powers and Strategic Stability in the Twenty-first Century: Competing Visions of World Order* (New York: Routledge, 2010); and National Intelligence Council, *Global Trends 2030*, 101-109.

³¹⁸ Amitav Acharya, "From the Unipolar Moment to a Multiplex World, *YaleGlobal Online*, 3 July 2014, <http://yaleglobal.yale.edu/content/unipolar-moment-multiplex-world>.

assess institutional strategic decisions and evaluate capability development efforts against not only the future favored by prevailing institutional policies, practices, and momentum, but also in the light of plausible, alternative futures developed through established foresight techniques. By considering multiple futures, the MCSEF aims to help increase the odds that Marine Corps preparations for an uncertain future security environment will hit the mark.

The MCSEF has multiple applications and uses—both specified and implied. The Futures Directorate Standard Operating Procedures (SOP) explicitly identifies several specific uses for the MCSEF:³¹⁹

- To support the first phase of the Marine Corps Capabilities Based Assessment (MC CBA)³²⁰ by providing a forecast and assessment of emerging security environments 15 to 30 years in the future to inform development of the Marine Corps capstone concept;
- To identify the threats, challenges, and opportunities that will most impact the ability of Marine Corps forces to accomplish their missions in emerging security environments 15 to 30 years in the future;
- To use as a stimulus in concept generation and wargaming forums;
- To support future scenario development by all Futures Directorate subordinate organizations and other USMC stakeholders/organizations when scenarios fall outside of Support for Strategic Analysis (SSA) scenarios; and,
- To support the Office of Science and Technology Integration, Science and Technology Division, Futures Directorate in developing and refining Marine Corps Science and Technology Objectives (STO).

Perhaps principal among these specified uses is the MCSEF's role in informing the development of the Marine Corps capstone concept. The MCSEF's examination and projection of patterns and trends in demographics, technology, resource competition, environmental stress, globalization, governance, the urban littorals, and the character of future conflict helps concept developers envision the Marine Corps' capstone concept in a military-technological context as well as in an environment shaped by other political, societal, and cultural factors.³²¹ Additionally, the MCSEF encourages a "deeper look" for Marine Corps concept developers beyond the 10-year future contemplated in *Expeditionary Force 21*, the MC CBA, and the Defense Planning Projection (DPP), which is defined as the Future Years Defense Program (FYDP) plus 10 years.

In addition to these specified uses, consideration of the MCSEF in the context of Marine Corps policies and programs reveals several implied uses, which will undoubtedly grow as the

³¹⁹ Deputy Commandant for Combat Development and Integration, Futures Directorate, "Standard Operating Procedures" (basic order, Futures Directorate, 2014), 3-5 and Annex C.

³²⁰ The Marine Corps Capabilities-Based Assessment (MC CBA) process will be promulgated in the forthcoming edition of MCO 3900.20, replacing MCO 3900.15B, Marine Corps Expeditionary Force Development.

³²¹ John F. Schmitt, *A Practical Guide for Developing and Writing Military Concepts (Working Paper #02-4)* (McLean, VA: Hicks & Associates, Inc., 2002), 14.

MCSEF gains acceptance across the Marine Corps. Potential additional uses for this inaugural MCSEF include:

- To inform future editions of the Marine Corps Intelligence Activity's *Future Operating Environment 2015-2025: Implications for Marines*;
- As a resource for Marine Corps Advocates and Proponents in execution of their responsibilities,³²² e.g., reviewing advocate campaign plans and roadmaps to evaluate Marine Corps and MAGTF capabilities in the context of plausible future security environments, as well as identification of capabilities and deficiencies within functional areas to be considered in the MC CBA;
- As a resource for Training and Education Command, e.g., to review training requirements vis-à-vis the forecast character of future conflict, to assign school seats for Foreign Military Officers (FMO) in Marine Corps schools, and to focus, develop, and refine cultural and language training;
- To support PP&O in reviewing foreign and Marine liaison officer programs, including Foreign Area Officer (FAO) and Regional Area Officer (RAO) assignments, by shedding light on the world's regions that will be most significant for national security in the future;
- As a resource for Marine Corps Fellows; and,
- As a resource for Marine component and Marine Expeditionary Force commanders and staff to better understand their areas of concern in the long-term context of multiple possible futures.

Ultimately, it is improbable that one of the futures envisioned in this forecast will be the future. By offering a range of plausible futures, however, this MCSEF serves as a tool that planners and decision makers can use to outfit the Marine Corps with a broad and adaptive capability set—one that will enable success in the face of whatever challenges the future does hold.

³²² See Marine Corps Order 5311.6 of 2 December 2013 for a full description of advocate and proponent responsibilities.

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Appendix A

Glossary

<u>Term</u>	<u>Definition</u>
3-D printing	An informal term for additive manufacturing that refers generally to any of various processes used to make a three-dimensional object.
A2/AD	Anti-access and area denial
additive manufacturing	Additive manufacturing (AM, also 3-D printing) refers generally to any of various processes used to make a three-dimensional object.
arc of instability	A geographic reference to describe areas stretching from sub-Saharan Africa through North Africa, into the Middle East, the Balkans, the Caucasus, and South and Central Asia, and parts of Southeast Asia. Some formulations add parts of the Caribbean Basin, Central American, and northern South America.
ASEAN	Association of Southeast Asian Nations
BCA	Budget Control Act
bibliometric	Statistical analysis of written publications, such as books or articles.
Big Data	Big data is a broad term for data sets so large or complex that traditional data processing applications are inadequate.
bioprinting	Making living tissue with a 3-D printer.
biotechnology	A broad discipline in which biological processes, organisms, cells, or cellular components are exploited to develop new technologies.
BRIC	Brazil, Russia, India, and China
C2	Command and control
<i>casus belli</i>	An act or event that provokes or is used to justify war.
CBA	Capabilities Based Assessment

<u>Term</u>	<u>Definition</u>
convergence	A modern theory according to which the economic, political, and ideological differences between the capitalist and socialist systems are gradually diminishing, leading ultimately to a merger of the two systems.
cyber	Cyber (or cyber-) is technically an adjective or prefix derived from "cybernetic," which comes from a Greek adjective meaning skilled in steering or governing. It means "of, relating to, or characteristic of the culture of computers, information technology, and virtual reality." It is a common term used in association with information technology, computers, and the Internet.
DARPA	Defense Advanced Research Projects Agency
<i>de facto</i>	In fact, or in effect, whether by right or not.
democratize	As generally used within this document, to make (something) accessible to everyone.
desertification	A type of land degradation in which a relatively dry land region becomes increasingly arid, typically losing its bodies of water as well as vegetation and wildlife. It may be caused by a variety of natural, environmental, and human factors.
directed energy	Highly focused energy, often transferred to a target.
DNA	Deoxyribonucleic acid. DNA is a molecule that encodes the genetic instructions used in the development and functioning of all known living organisms and many viruses.
DPP	Defense Planning Projection
E7	Emerging Seven, comprising Brazil, China, India, Indonesia, Mexico, Russia, and Turkey.
ecomigrants	Migrants who relocate seeking refuge from destruction or severe degradation of essential natural resources.
ecomigration	Ecomigration is population movement caused by destruction or severe degradation of essential natural resources.
ethnic cleansing	The systematic forced removal of ethnic or religious groups from a given territory by a more powerful ethnic group, with the intent of making the territory ethnically homogeneous.
EU	European Union

<u>Term</u>	<u>Definition</u>
eurozone	Monetary union of 19 European Union member states that have adopted the euro (€) as their common currency and sole legal tender. The eurozone comprises Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia, and Spain.
exurb	A region or settlement that lies outside a city and usually beyond its suburbs and that often is inhabited chiefly by well-to-do families.
F-22	The F-22 Raptor is a single-seat, twin-engine, all-weather stealth tactical fighter aircraft developed for the United States Air Force (USAF).
F-35	The F-35 Lightning II jet fighter (also known as the Joint Strike Fighter) is the Department of Defense's next-generation strike aircraft weapon systems for the Navy, Air Force, Marines, and various U.S. allies.
FAO	Foreign Area Officer
FMO	Foreign Military Officer
five-dimension battlespace	A dimension is a realm characterized by a specific feature and governed by its own rules. The most familiar dimension is space, which is three-dimensional and comprised of the physical characteristics of length, width and height. The fourth dimension is time, accounting for what has occurred in the past, is happening now, and what will occur in the future. The fifth dimension is cyberspace, or the informational domain. Some usages may treat underwater, subsurface, and interior urban spaces as additional dimensions.
FYDP	Future Years Defense Program
G7	Group of Seven, comprising Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States
G20	The Group of 20 is an international forum for the governments and central bank governors from 20 major economies. Members include Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Mexico, Russia, Saudi Arabia, South Africa, South Korea, Turkey, the United Kingdom, the United States, and the European Union.
GDP	Gross domestic product

<u>Term</u>	<u>Definition</u>
globalization	Globalization involves the growing international integration of economies, including labor, capital, and intellectual capital markets; societies; cultures; and worldviews. Advances in transportation capability and telecommunications technology are key catalysts for the ongoing process of globalization.
guns or butter	In macroeconomics, “guns versus butter” references the relationship between a nation's decision to invest in defense or civilian goods. For example, a nation has to choose between two options when spending its finite resources. It may buy either guns (invest in defense/military) or butter (invest in production of consumer goods), or a combination of both. This may be seen as an analogy for choices between defense and civilian spending in more complex economies.
HA/DR	Humanitarian assistance/disaster relief
Human 3.0	Describes the process that incorporates how advancements in robotics, nanotechnology, neurology, and genetics are combining with human biology to improve substantially human health, physical performance, and mental acuity.
ICC	International Criminal Court
IED	Improvised explosive device
IMF	International Monetary Fund
<i>inter alia</i>	Latin for "among other things."
Internet of Things	Internet of Things (IoT) is the network of physical objects or "things" embedded with electronics, software, sensors, and connectivity to enable it to achieve greater value and service by exchanging data with the manufacturer, operator, and/or other connected devices. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure.
INTERPOL	International Criminal Police Organization
ISIL	Islamic State of Iraq and the Levant, also known as Islamic State of Iraq and Syria or Islamic State of Iraq and ash-Sham (ISIS) or, simply, Islamic State
ISR	Intelligence, surveillance, and reconnaissance
MAGTF	Marine Air-Ground Task Force

<u>Term</u>	<u>Definition</u>
Malthusian	A school of ideas derived from the political/economic thought of the Reverend Thomas Robert Malthus, as laid out in his 1798 writings, <i>An Essay on the Principle of Population</i> . Malthus' theory contends that a population tends to increase at a faster rate than their means of subsistence, and that unless it is checked by moral restraint or disaster (such as disease, famine, or war), widespread poverty and degradation inevitably result.
MEF	Marine Expeditionary Force
megacity	Usually defined as a metropolitan area with a total population in excess of 10 million people. A megacity can be a single metropolitan area or two or more metropolitan areas that converge.
MER	Market exchange rates
metacity	A heterogeneous, dynamic urban region composed of multiple dense centers, intervening suburbs, embedded green spaces, and diffuse boundaries between traditional cities, suburbs, and exurbs. For example, the area comprising the areas surrounding New York City, Jersey City, and Newark might be described as a metacity.
MEU	Marine Expeditionary Unit
MPF	Maritime Prepositioning Force
multipolar world	A distribution of power in which more than two nation-states have nearly equal amounts of military, cultural, and economic influence. For example, a multipolar world may feature the U.S., China, and Russia as major global powers.
nanotechnology	Nanotechnology is science, engineering, and technology conducted at the nanoscale, which is about 1 to 100 nanometers. Nanoscience and nanotechnology are the study and application of extremely small things and can be used across all the other science fields, such as chemistry, biology, physics, materials science, and engineering.
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
NextGen	Next Generation, often in reference to the next generation of system or technology.
NGO	Nongovernmental organization
NIC	National Intelligence Council

<u>Term</u>	<u>Definition</u>
NIH	National Institutes of Health
NSF	National Science Foundation
OAU	Organization for African Unity
OECD	Organization for Economic Cooperation and Development
P5 plus 1	A group of six world powers which, in 2006, joined the diplomatic efforts with Iran with regard to its nuclear program. The term refers to the five permanent members of the UN Security Council, namely China, France, Russia, the United Kingdom, and the United States, plus Germany.
pensioner bulge	Refers to the aging populations and substantial percentage of senior citizens in many developed countries, forecast to have significant impact. Opposite is the youth bulge.
peri-urban	Generally refers to the area immediately adjoining an urban area; between the suburbs and the countryside. Characteristics of city/suburban and rural living merge in this area, creating a unique operating area.
polycentric	Having more than one center.
POM	Program Objective Memorandum is a recommendation from the Services and Defense Agencies to the Secretary of Defense concerning how they plan to allocate resources.
PPP	Purchasing power parity
quantum computing	Quantum computing involves theoretical computation systems (quantum computers) that make direct use of quantum-mechanical phenomena to perform operations on data. Quantum computers are different from digital computers based on transistors. Whereas digital computers require data to be encoded into binary digits (bits), each of which is always in one of two definite states (0 or 1), quantum computation uses qubits (quantum bits), which are not limited to two definite states.
R&D	Research and development
RAO	Regional Area Officer
robotics and autonomous systems	A reference to a class of systems that is augmented with or exclusively employs unmanned or partially manned systems that also have varying levels of autonomy.

<u>Term</u>	<u>Definition</u>
ruin-causing knowledge	Ruin-causing knowledge (RCK) encompasses the “core principles, core technology, and other core knowledge used to produce various products and schemes that can be used to cause devastating catastrophes, such as weapons of mass destruction.” The term was coined and defined by Professor Yidong Liu, Director of the Center for the Study on the Development Strategies of Disciplines, Academic Divisions of Chinese Academy of Sciences in Beijing, China.
S&T	Science and technology
semantic	The study of meaning, focusing on the relation between signifiers, like words, phrases, signs, and symbols, and what they stand for.
shapeshifting	In mythology, a metamorphosis: the ability of an entity to physically transform into another being or form. In warfare, a term used to describe the changing character of warfare and its participants.
smart grid	A modernized electrical grid that uses information and communications technology to gather and act on information in an automated fashion to improve the efficiency, reliability, economics, and sustainability of the production and distribution of electricity.
SOP	Standard Operating Procedures
SPMAGTF	Special Purpose Marine Air-Ground Task Force
SSA	Support for Strategic Analysis
STO	Science and Technology Objectives
supersurface	The manmade vertical landscape typically found most prevalently within an urban area and characterized by tall buildings, antennas, other structures.
synthetic biology	Refers to both the design and fabrication of biological components and systems that do not already exist in the natural world, and the re-design and fabrication of existing biological systems.
transnational crime	Refers to crimes that have actual or potential effect across national borders and crimes which are intrastate but which offend fundamental values of the international community.
UAV	unmanned aerial vehicles
UN	United Nations

<u>Term</u>	<u>Definition</u>
urban littorals	Refers to the increasing trend for population growth within urban areas that are close to the coastal areas in many countries.
USAID	U.S. Agency for International Development
USDA	U.S. Department of Agriculture
UUV	unmanned underwater vehicles
WEF	World Economic Forum
whole-of-government	Government and public service agencies working across portfolio boundaries to achieve a shared goal and an integrated response to particular issues.
whole-of-society	Refers to a comprehensive approach to solutions that expands participation beyond government and public service agencies, and includes the interests and perspectives of diverse sectors of civil society such as non-government organizations, commercial companies, industry, private volunteer organizations, and individual citizens.
World Wide Web Consortium	An international community that develops open standards to ensure the long-term growth of the Web.
youth bulge	Describes a demographic phenomenon in which the share of the population aged 15-24 (15-29 in some analyses) relative to the working age population (normally 15-59, but 15-64 in some analyses) is unusually high, typically with an excess of young adult males. This may contribute to social unrest, war, and terrorism. Opposite is the pensioner bulge.



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